Water Appropriations Consolidated Permit Application

Individual Non-Irrigation

Prepared for Poly Met Mining, Inc.



Version 2 February 2017



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List of Acronyms and Abbreviations

Acronym or Abbreviation Description

BIF Biwabik Iron Formation

CE Cliffs Erie, LLC

CPS Central Pumping Station

CWMP Comprehensive Water Management Plan Final Environmental Impact Statement

FTB Flotation Tailings Basin

General Permit Water Appropriations General Permit for Temporary Projects (Permit

#1997-0005)

GPM Gallons per Minute

HRF Hydrometallurgical Residue Facility

Individual Permits Individual Non-Irrigation Water Appropriations Permits

LTVSMC LTV Steel Mining Company

MDNR Minnesota Department of Natural Resources

MPCA Minnesota Pollution Control Agency

NPDES National Pollutant Discharge Elimination System

NSPS New Source Performance Standard

Project NorthMet Project
PolyMet Poly Met Mining, Inc.
SDS State Disposal System

SWPPP Stormwater Pollution Prevention Plan

USGS U.S. Geological Survey

WWTF Waste Water Treatment Facility
WWTP Waste Water Treatment Plant

1.0 Introduction

Poly Met Mining, Inc. (PolyMet) is proposing to develop the NorthMet Project (Project) copper-nickel-platinum-group elements (PGE) mine and associated processing facilities. The Project is described in the NorthMet Mining Project and Land Exchange Final Environmental Impact Statement (FEIS) (Reference (1)). The Project is located south of the city of Babbitt and north of the city of Hoyt Lakes in St. Louis County, Minnesota, as shown on Large Figure 1.

The Project consists of the Mine Site, the Plant Site, and the Transportation and Utility Corridors that connect them. The Mine Site is a greenfield site that will be developed into an open pit mine and is located approximately six miles south of the city of Babbitt and two miles south of the Northshore Mining Company's active, open pit taconite mine (known as the Peter Mitchell Mine). Development of the Mine Site for the Project will include construction of new facilities, including mine pits, ore handling facilities, waste rock stockpiles, an overburden storage area, mine water management systems, a Waste Water Treatment Facility (WWTF), and supporting infrastructure. The Plant Site, located west of the Mine Site, is a brownfield site, including a former taconite process plant and tailings basin previously operated by LTV Steel Mining Company (LTVSMC). Redevelopment of the Plant Site for the Project will include refurbishment of former LTVSMC processing facilities and construction of new facilities. Plant Site features will include a Beneficiation Plant, a Hydrometallurgical Plant, other processing facilities, a Flotation Tailings Basin (FTB), a Hydrometallurgical Residue Facility (HRF), a Waste Water Treatment Plant (WWTP), a Sewage Treatment System, and other ancillary facilities (e.g., Colby Lake water pipeline). The Beneficiation Plant will produce Flotation Tailings throughout the 20 years of ore processing. Flotation Tailings, which are the materials remaining after metallic sulfide minerals are liberated from the finely ground ore in the flotation process, will be deposited in the FTB, which will be placed on top of a portion of the existing former LTVSMC tailings basin. In this permit application, the "FTB" means the newly constructed NorthMet Flotation Tailings Basin, the "LTVSMC tailings basin" means the existing former LTVSMC tailings basin, and the "Tailings Basin" means the combined LTVSMC tailings basin and the FTB. The Mine Site and the Plant Site are connected by approximately 7- to 8-mile-long Transportation and Utility Corridors, which will include new and upgraded infrastructure to link activities at the Mine Site and Plant Site. The location of the Project is shown in Large Figure 1.

This document presents the information required by the Minnesota Department of Natural Resources (MDNR) for the issuance of six Individual Non-Irrigation Water Appropriations Permits (Individual Permits) to PolyMet for the Project. Application forms are included in Appendix A. To provide context, this document also describes the overall Project water appropriations permitting approach.

As shown on Large Figure 1, portions of the Project are located within the municipal boundaries of both Hoyt Lakes and Babbitt; therefore, copies of this application has been submitted to both of these cities and the North St. Louis Soil and Water Conservation District, as required by Minnesota Rules, subpart 3(D). Cover letters documenting these submittals are included in Appendix B, and an affidavit will be submitted separately to the MDNR to document the mailing of these copies.

The Project will include four phases:

- Pre-operation construction, which will last for approximately 18 to 24 months, will include temporary dewatering for construction of infrastructure and engineering controls, and for overburden stripping in preparation for mining.
- Operation, which will last approximately 20 years, will include dewatering of the mine pits, and dewatering for operation of engineering controls.
- Reclamation, which will take place after mining ceases, will include pumping water from the mine pits, treating it, then returning it to the pits, in order to improve water quality in the flooded pits.
- Long-term closure, which will last for an unknown duration, does not include water appropriations.

This application for Individual Permits provides information on expected appropriations schedules and rates from the pre-operation construction phase through the operation phase. The planned permit coverage is based on current estimates of water flow rate and duration. If water flow rate or duration differs from what is expected to the extent that a change in water appropriation permit coverage is required, PolyMet will apply for amendments or additional permit coverage, as required.

Appropriations from the mine pits will continue, subject to applicable permit terms, into the reclamation phase. If appropriations sources, rates, or quantities change substantially during reclamation, PolyMet will apply for amendments or additional permit coverage, as required.

The outline of this application is:

Section 1.0	Provides an introduction and outline of this application document.
Section 2.0	Summarizes the statute and rule requirements related to water appropriation and the applicability of those requirements to the Project.
Section 3.0	Describes the overall Project water appropriations permitting approach, the Project water conservation and reuse strategy, and the water that will be released from the Project.
Section 4.0	Provides information on location and ownership of proposed appropriation locations.
Section 5.0	Describes the need for the appropriations and establishes that the appropriations are reasonable and practical, including information on proposed pumping rates, schedules and volumes.
Section 6.0	Provides the additional information required for dewatering.
Section 7.0	Provides the additional information required for appropriations associated with mining. Addresses certain Individual Permit requirements common to the Mine Site and Plant Site.

Section 8.0	Describes the Project's compliance with groundwater sustainability and water supply management requirements.
Section 9.0	Presents the proposed water appropriations monitoring plan.
Section 10.0	Lists references.

2.0 Regulatory Context

"Waters of the state," which include both surface water and groundwater, may not be appropriated without a water use (or "appropriation") permit from MDNR except in limited circumstances (Minnesota Statutes section 103G.271, subdivision 1). Chapter 103G of the Minnesota Statutes and Chapter 6115 of the MDNR's rules set forth the requirements for appropriating waters of the state. Appropriation is broadly defined as the "withdrawal, removal, or transfer of water from its source regardless of how the water is used" (Minnesota Statutes, section 103G.005, subdivision 4). Types of withdrawals that do not require an appropriation permit include:

- withdrawals of less than 10,000 gallons per day and totaling no more than 1 million gallons per year (Minnesota Rules, part 6115.0620(C))
- recapture of water that has been previously appropriated, such as collection of tailings basin seepage by the FTB Seepage Containment System (Minnesota Rules, part 6115.0620(E))
- management of stormwater, which does not meet the definition of "waters of the state1" because
 it is "... spread and diffused over the land" (Minnesota Rules, part 6115.0630, subpart 18)
- test pumping of a groundwater source (Minnesota Rules, part 6115.0620(B)

MDNR rules require permit applications for each non-exempt surface or groundwater "source" from which water is proposed to be appropriated (Minnesota Rules, part 6115.0660, subpart 1). The term "source" is not expressly defined in the applicable statute or rule, however prior MDNR practice has been to treat each mine pit as a "source." Two forms of appropriation permit coverage are available: individual appropriations permits and General Permits (e.g. Temporary Projects General Permit 1997-0005). Individual appropriations permits are required for users withdrawing more than 10,000 gallons of water per day or greater than one million gallons per year for agricultural, irrigation, and non-irrigation purposes (Minnesota Rules, part 6115.0620). PolyMet is not applying for coverage under the Temporary Projects General Permit.

Requirements for appropriations under Individual Permits vary depending on the type of source (surface water or groundwater) and the purpose of the appropriation (irrigation, public water supply, dewatering, and mining) (Minnesota Rules, part 6115.0660 – .0720). Key regulatory requirements for Individual Permits include the following:

- All permit applications must provide the information specified in Minnesota Rules, part 6115.0660.
- Minnesota Rules, part 6115.0670 identifies review and analysis that MDNR must conduct with respect to each permit application.

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¹ "Waters of the state" means "any waters, surface or underground, except those surface waters which are not confined but are spread and diffused over the land" (Minnesota Rules, part 6115.0630, subpart 18).

- Applications for permits for dewatering and permits for appropriations related to mining and mineral processing are subject to additional requirements and substantive standards (Minnesota Rules, part 6115.0720).
- Monitoring and recordkeeping is required under all permits. The quantity of water appropriated must be recorded, and for appropriations of groundwater, water levels must be monitored. (Minnesota Rules, part 6115.0750, subpart 3).
- Appropriations of groundwater must comply with the groundwater sustainability standard (Minnesota Statutes, section 103G.287, subdivision 5).
- Appropriations that involve "consumptive uses" above specified volumes must comply with water supply management requirements (Minnesota Statutes, section 103G.265, subdivisions 3 and 4).

Another regulatory element concerning PolyMet's water appropriation proposal is that some of the water withdrawn by PolyMet will be used to augment streamflow, to avoid ecologic and hydrologic impacts. These activities will be monitored and reported under MDNR's water appropriation permit requirements under Minnesota Rules, chapter 6115; however, they are a topic for interagency co-ordination because they also have implications under Minnesota Pollution Control Agency's (MPCA) water quality protection requirements under Minnesota Rules chapters 7050 and 7052.

3.0 NorthMet Water Appropriations Overview

PolyMet will pump groundwater to mine ore, operate engineering controls, and construct buildings and other infrastructure that extend below the water table. PolyMet will also pump surface water from Colby Lake when make-up water is needed at the Plant Site.² The Project Water Management Plans (Reference (2) and Reference (3)) emphasize conservation and reuse. Water appropriated for mining activities will be used as process water for the Beneficiation Plant to the extent possible, minimizing the amount of make-up water that will be needed from Colby Lake, and minimizing the amount of appropriated water that may be released off-site. Excess water from the Project will be treated at the Plant Site WWTP, then discharged to Trimble Creek, Unnamed Creek, and Second Creek. Discharge quality will meet applicable effluent limits and surface water quality standards, and discharge quantity will be managed to meet the zero discharge requirements of the New Source Performance Standard (NSPS),³ and to minimize ecologic and hydrologic impacts to the receiving waters.

The following subsections present an overview of the NorthMet water appropriations permitting approach, summarize the Project water conservation and reuse strategies and methods, describe Project discharges, and present Project plans for stream augmentation.

3.1 Water Appropriations Permitting Approach

The Project will obtain Individual Permit coverage for all withdrawals that require a water appropriation permit. Large Figure 2 and Large Figure 3 present flow diagrams of anticipated permitted Project water appropriations during the pre-operation construction phase and operation phase, respectively.

3.1.1 Individual Permits

This consolidated application is for six Individual Permits: one permit for each of the three mine pits, one for dewatering during construction and operations of Mine Site Infrastructure, one for dewatering during construction and operations of Plant Site Infrastructure, and one for withdrawal of water from Colby Lake for use as make-up water for the Plant Site. Individual Permit application forms are included in Appendix A. Application information required by Minnesota statutes and rules, as described in Section 2.0, is provided in Sections 4.0 through 7.7 of this application document. The six Individual Permits are summarized in Table 3-1.

40 C.1.10., 30001011 440.104

6

² Make-up water from Colby Lake will primarily be used to process ore, supplement the hydrometallurgical process, and provide stream augmentation. Additional, secondary uses of make-up water will be to startup the Tailings Basin operations, aid in maintaining water levels in the Tailings Basin, and supply water for the potable water treatment plant, fire water, dust control, air emission control scrubber system water, gland seal water, and miscellaneous Project water needs for construction and operation.

³40 C.F.R., section 440.104.

Table 3-1 Summary of NorthMet Individual Permits

Individual Permit	Location	Dewatering Activities	Dewatering Time Frame	Form Number
East Pit	Mine Site	overburden strippingpit dewatering	Pre-operation construction phase to Mine Year 20	1
Central Pit	Mine Site	overburden strippingpit dewatering	Operation phase (Mine Year 11 to 20)	2
West Pit	Mine Site	overburden strippingpit dewatering	Operation phase (Mine Year 2 to 20)	3
Mine Site Infrastructure	Mine Site	 temporary construction dewatering Category 1 Stockpile Groundwater Containment System operation Stockpile underdrain operation (if needed) 	Pre-operation construction phase to Mine Year 20	4
Plant Site Infrastructure	 temporary construction dewatering Hydrometallurgical Residue Facility (HRF) wick drain operation (if needed) 		Pre-operation construction phase to Mine Year 20	5
Colby Lake	Plant Site	withdrawal to supply make-up water to the Plant Site	Pre-operation construction phase to Mine Year 20	6

3.1.2 Exempt Sources

Several Project water withdrawals will be exempt from water appropriations permitting requirements. As listed in Table 3-2, exempt sources involve management of stormwater, non-mechanical dewatering, and collection of previously appropriated water.

Table 3-2 NorthMet Sources That Do Not Require a Water Appropriations Permit

Water Source	Location	Appropriations Period	Source Water	Rationale
Test pumping during installation of groundwater monitoring wells	Mine Site and Plant Site	Pre-operation construction	Groundwater	Exempt in rule (Minnesota Rules, part 6115.0620(C)
Stormwater pumped/diverted from construction areas	Mine Site and Plant Site	Pre-operation construction, and construction during operation	Stormwater	Stormwater is an exempt source
Mine water collection on lined or compacted features (e.g., waste rock stockpiles, ore surge pile, haul roads)	Mine Site	Operation	Stormwater	Stormwater is an exempt source
Flotation Tailings Basin (FTB) seepage capture systems	Plant Site	Operation	Tailings basin seepage	Previously appropriation water
Hydrometallurgical Residue Facility (HRF) drainage collection system	Plant Site	Operation	HRF drainage	Previously appropriation water

3.2 Water Conservation and Reuse

The overall Project water management strategy is integrated across the Mine and Plant Sites in order to maximize water conservation and recycling. Appropriated groundwater from the Mine Site will be routed to the Plant Site to serve as process water, minimizing the amount of make-up water that will be withdrawn from Colby Lake. All water described below as being pumped to the FTB will be used as process water at the Beneficiation Plant. The strategy includes the following activities:

- Groundwater appropriated for dewatering associated with overburden stripping and mining will be treated and pumped to the FTB.
- Groundwater withdrawn by the Category 1 Stockpile Groundwater Containment System will be treated and pumped to the FTB.
- Mine Site runoff and most construction stormwater will be treated and pumped to the FTB.
- Process water will be recycled between the Beneficiation Plant and the FTB.
- Process water will be recycled between the Hydrometallurgical Plant and the HRF.
- Seepage from the Tailings Basin will be captured, and as much as possible will be returned to the FTB for reuse as process water. Seepage in excess of what can be recycled to the FTB will be

treated at the WWTP, then discharged to the environment as stream augmentation. Discharge quality will meet applicable effluent limits and surface water quality standards, and discharge quantity will be managed to meet the zero discharge requirements of the NSPS and to minimize ecologic and hydrologic impacts to the receiving waters.

The integrated water management strategy is expected to provide 88% to 98% of the process water needed by the Project, minimizing the amount of make-up water appropriated from Colby Lake. The amount of make-up water needed will vary over the course of operations, depending primarily on the amount of pit dewatering. When pit dewatering rates are higher, the Colby Lake appropriation rates will be lower. Large Figure 4 shows the annual average flows in Mine Year 10, illustrating the extent of water recycling that has been designed into the Project.

3.3 Stream Augmentation

Because the FTB seepage capture systems will block seepage from the existing LTVSMC tailings basin that currently flows to Trimble Creek, Unnamed Creek, Second Creek, and Unnamed (Mud Lake) Creek. PolyMet has agreed to augment flow in these streams to avoid ecologic and hydrologic impacts. The stream augmentation objective, as stated in the FEIS, is to limit the change in average annual flow to $\pm 20\%$ of existing conditions (conditions before the implementation of short term mitigation measures as part of the CE Consent Decree) (Section 5.2.2 of Reference (1)).

PolyMet will augment the streamflow by discharging treated effluent from the WWTP to the headwater areas of Trimble Creek, Unnamed Creek, and Second Creek under the terms of a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit, and diverting runoff that currently flows into the Tailing Basin, so that it flows to the Unnamed (Mud Lake) Creek watershed via a drainage swale. Section 3.4 summarizes additional regulatory requirements applicable to this augmentation.

3.4 Discharges

During the pre-operation construction phase, appropriated water will either be pumped to the Construction Mine Water Basin or released off-site under terms of an MPCA stormwater construction permit and associated Stormwater Pollution Prevention Plan (SWPPP). Water that will be released off-site during pre-operation construction is illustrated on Large Figure 2.

During the operation phase, the Project will discharge treated effluent from the WWTP to augment water flows in Trimble Creek, Unnamed Creek, and Second Creek under terms of an MPCA NPDES/SDS permit. The three receiving waters are in the St. Louis River watershed of the Great Lakes Basin. Trimble and Unnamed Creeks are tributaries of the Embarrass River, and Second Creek is a tributary of the Partridge River.

The WWTP discharge rate (annual average mean) is estimated to vary from approximately 1,700 to 2,700 gpm, as shown in Figure 3-1. The discharge will include water appropriated from the Mine Site and from Colby Lake that has been added to the FTB pond, has seeped down through the tailings to the toe of the

Tailings Basin, been captured by the FTB seepage capture systems, and routed to the WWTP for treatment. WWTP discharge and associated appropriations flows during operations are illustrated on Large Figure 3.

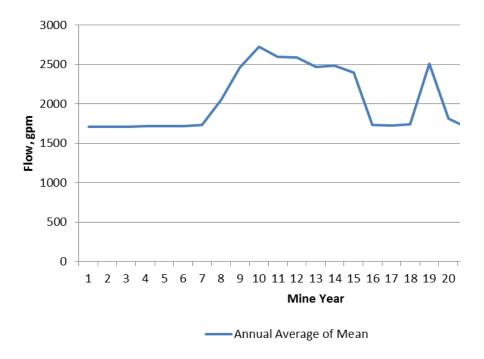


Figure 3-1 Annual Average Waste Water Treatment Plant Discharge Rate based on Mean Flows

4.0 Location and Ownership

Large Figure 5 shows the configuration of the Mine Site in Mine Year 11 and the approximate locations of the pumping installations associated with the East Pit, Central Pit, West Pit and Mine Site Infrastructure Permits. Some temporary construction dewatering activities associated with the Mine Site Infrastructure Permit that will occur at various locations (e.g. construction of new buildings, miscellaneous construction dewatering, etc.) are listed, but not specifically shown, on Large Figure 5.

Large Figure 6 shows the configuration of the Plant Site during the construction phase and the approximate locations of the primary pumping installations associated with the Plant Site Infrastructure Permit. Some temporary construction dewatering activities associated with the Plant Site Infrastructure Permit that will occur at various locations (e.g. miscellaneous construction dewatering) are listed, but not specifically shown, on Large Figure 6.

Large Figure 11 shows the location of the Colby Lake Pumphouse, the Colby Lake Pipeline, and the Plant Reservoir. Temporary construction dewatering associated with necessary repairs of the Colby Lake Pipeline will be covered by the Plant Site Infrastructure Water Appropriation Permit.

Under Minnesota Rules, part 6115.0660, subpart 2, the permit applicant must provide "written evidence of ownership, or control of, or license to use, the land overlying the groundwater source or abutting the surface water source from which water will be appropriated." PolyMet will assume ownership of the surface lands at the Mine Site, including the appropriation points, upon completion of the pending land exchange with the U.S. Forest Service, as shown on Large Figure 5. In addition, PolyMet currently leases the private mineral rights underlying the Mine Site. These mineral rights not only provide PolyMet with access to the subsurface at the Mine Site for purposes of mining, they also provide the legal basis for accessing surface lands as necessary to carry out mining activities, which include water appropriation from surface water and groundwater sources. Accordingly, PolyMet has the requisite control of Mine Site water appropriation sources to satisfy the requirements of Minnesota Rules, part 6115.0660, subpart 2.

PolyMet controls the lands overlying the groundwater source or abutting the surface water source from which water will be appropriated at the Plant Site and Colby Lake, as shown on Large Figure 6. Specifically, under its contractual arrangements with CE, PolyMet currently holds equitable title to the Plant Site and all necessary rights for possession, access, and use of the Plant Site. Upon completion of certain conditions, CE is required to convey fee simple title to PolyMet. PolyMet also has contractual arrangements with Cliffs Erie and Minnesota Power with respect to PolyMet's control of the Colby Lake pumphouse and pipeline, as well as for access to the riparian land abutting Colby Lake on which the pumphouse and associated equipment are located. The current and future rights held by PolyMet provide it with sufficient control of the Plant Site and the Colby Lake facilities to satisfy the access requirements of Minnesota Rules 6115.0660, subpart 2.

5.0 Statement of Justification for Individual Permits

Dewatering is necessary for PolyMet to construct mining facilities, mine copper-nickel ore from open pits, and operate environmental controls. Withdrawal of water from Colby Lake is necessary for PolyMet to provide make-up water to the Plant Site (uses of make-up water are described in Section 3.0). The water appropriations proposed under the six Individual Permits are reasonable and practical, as detailed in the following subsections, and is necessary for the Project to provide the social and economic benefits documented in Section 5.2.10 of the FEIS (Reference (1)).

5.1 Overview and Pumping Schedule

PolyMet is applying for six Individual Permits: one permit for each of the three mine pits, one for dewatering during construction and operations of Mine Site Infrastructure, one for dewatering during construction and operations of Plant Site Infrastructure and one for withdrawal of water from Colby Lake.

Table 5-1 provides an overview of the Individual Permits, the installations covered under each permit, and the schedule for pumping from each installation. The pumping schedule was estimated based on the Project schedule as detailed in the FEIS and the preliminary schedule for construction of Project infrastructure.

Table 5-1 Individual Permit Overview

Individual Permit	Installation	Dewatering schedule
East Pit	Overburden stripping	Pre-operation construction phase
East Pit	East Pit Sump	Mine Years 1 to 20
C	Overburden stripping	Mine Year 11
Central Pit	Central Pit Sump	Mine Years 11 to 20
Mari Di	Overburden stripping	Intermittent, Mine Years 2 to 11
West Pit	West Pit Sump 1 and Sump 2	Mine Years 2 to 20

Individual Permit	Installation	Dewatering schedule	
	Ore Surge Pile foundation, sumps, and overflow ponds construction	Pre-operation construction	
	Construction of new buildings	Pre-operation construction	
	Mine water pond construction	Intermittent, pre-operation construction to Mine Year 6	
	Stormwater pond construction	Intermittent, pre-operation construction to Mine Year 2	
	Category 4 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction and Mine Year 3	
	Category 2/3 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction to Mine Year 6	
Mine Site Infrastructure	Category 1 Waste Rock Stockpile foundation construction	Intermittent, pre-operation construction to Mine Year 6	
	Category 1 Stockpile Groundwater Containment System construction	Intermittent, pre-operation construction to Mine Year 5	
	Category 1 Stockpile Groundwater Containment System operation	Mine Years 1 to 21	
	Category 2/3 Waste Rock Stockpile underdrains, if needed	Mine Years 1 to 19	
	Category 4 Waste Rock Stockpile underdrains, if needed	Mine Years 1 to 11	
	Ore Surge Pile underdrains, if needed	Mine Years 1 to 20	
	Miscellaneous construction dewatering	Intermittent, as needed	
	Flotation Tailings Basin (FTB) Seepage Containment System construction	Intermittent, pre-operations construction and Mine Year 7	
	Sewage Treatment System construction	Pre-operations construction	
Plant Site	Hydrometallurgical Residue Facility (HRF) construction	Intermittent, Pre-operations construction and Mine Year 3	
Infrastructure	HRF wick drains, if needed	Pre-operations construction to Mine Year 20	
	Colby Lake pipeline upgrades	Pre-operations construction	
	Miscellaneous construction dewatering	Intermittent, as needed	
Colby Lake	Colby Lake Pump House	Pre-operation construction phase to Mine Year 20	

5.2 Hydrogeology and Hydrology of Water Sources

5.2.1 Mine Site

Water appropriations at the Mine Site will be primarily drawn from two hydrogeologic units: the unconsolidated deposits (known as the "surficial aquifer", Section 5.2.1.1) and bedrock (Section 5.2.1.2). These hydrogeologic units and the field investigations performed for the Project are described in detail in the FEIS (Section 4.2.2.2.1 of Reference (1)) and Project documents (Section 4.3 of Reference (4)). See also the test hole data and long-term water level measurements referenced in Section 5.2.1.3 of this application, and hydrologic studies referenced in Section 5.2.1.4 of this application. This information provides the basis for the groundwater appropriation estimates supporting PolyMet's four Mine Site Individual Permit applications.

5.2.1.1 Mine Site Surficial Aquifer

The Mine Site is covered with peat and glacigenic sediments, including outwash and bouldery till. Based on drilling, geophysics, and outcrop mapping, the depth to bedrock across the Mine Site ranges from 0 to approximately 60 feet. The thickest unconsolidated deposits are generally associated with wetland areas, which tend to fill pre-existing depressions in bedrock. The depth to groundwater is typically less than 10 feet. Field testing of the various unconsolidated deposits found a range of hydraulic conductivity values from 0.012 to 31 feet/day. The ability of the surficial aquifer to transmit water, however, is related to the thickness of the sediments. Groundwater flow paths are likely short because of the thin and discontinuous nature of the surficial aquifer. Work conducted to-date has not identified laterally continuous outwash sand or gravel deposits that might be preferential groundwater conduits within the surficial deposits. There are no private wells in the surficial aquifer in the vicinity of the Mine Site.

The water table is generally a subdued replica of the land surface, with upland areas generally associated with groundwater divides. In general, groundwater levels fluctuate seasonally, rising in spring and early summer in response to snowmelt and rainfall, and falling through late summer/fall into winter lows. The magnitude of groundwater elevation fluctuation varies by well across the Mine Site, but the overall annual fluctuation of water levels observed at a single well is typically less than four feet.

Wetlands extend into the Mine Site. Information from well logs, soil borings, soil mapping, and wetland characterization suggest that, in some areas, wetlands have minimal hydraulic connection to the underlying groundwater. A 2010 field survey, for example, found that most of the wetlands on the Mine Site (69%) were "ombrotrophic bogs", a type of wetlands almost entirely supported (with water and minerals) by direct precipitation (Section 4.2.3.1.2 of Reference (1)).

5.2.1.2 Mine Site Bedrock

The NorthMet Deposit is located within the Partridge River Intrusion of the Duluth Complex, which subcrops at the Mine Site and dips to the southeast. Underlying the Duluth Complex is the Virginia Formation, a metasedimentary rock, which sub-crops to the north of the Mine Site. Mining will occur near the contact between the Duluth Complex and the Virginia Formation, and during mining operations, the Virginia Formation will be exposed along portions of the northern wall of the East Pit. Underlying the

Virginia Formation is the Biwabik Iron Formation (BIF), which is the source of taconite iron ore. The BIF is used regionally as a water resource (for example, by the City of Biwabik); however, there are no residential or community wells in the immediate vicinity of the Mine Site. Current drilling and interpolation of geology between drill holes indicates there will be approximately 130-150 feet of separation between the BIF and the final extent of the mine pits.

Groundwater flow within bedrock is primarily through fractures (i.e., secondary porosity features). The BIF is generally considered to be the most permeable bedrock unit, followed by the Virginia Formation, with the Duluth Complex having hydraulic conductivity at least one order of magnitude lower. Specific capacity tests conducted in the Virginia Formation wells P-3 and P-4 indicate that the upper portion of the Virginia Formation is more permeable than the lower portion. This is consistent with observations from the Duluth Complex, where the upper 200 to 300 feet of the formation is more extensively fractured and jointed, potentially resulting in increased permeability. Additional information on bedrock hydrogeology is presented in Section 4.3.3.2 of Reference (4).

5.2.1.3 Mine Site Test Hole Data

Since 2005, a number of subsurface investigations have been conducted at the Mine Site to develop and refine the hydrogeologic and geologic models of the site. The investigations are summarized in Section 4.3.1 of Reference (4). Hydrogeologic data collection locations are shown on Large Figure 2 of Reference (4).

Boring logs for surficial and bedrock borings at the Mine Site are provided in Attachment A to Reference (4). At the Mine Site, PolyMet has measured groundwater levels at 21 locations in the surficial aquifer for between three and ten years each, and at five locations in bedrock for up to nine years. Water level records are provided in Large Table 1 and Large Table 2 of Attachment B to Reference (4).

Hydrologic testing of the unconsolidated and bedrock material at the Mine Site was performed in three separate phases between 2005 and 2006. Individual test results are documented in References (5), (6), and (7).

5.2.1.4 Mine Site Hydrology

PolyMet developed a MODFLOW model of the Mine Site (Attachment B to Reference (4)), which was calibrated for existing conditions using measured groundwater elevations in wells completed in the surficial aquifer and bedrock, as well as estimates of baseflow in the Partridge River. This model is the basis for projected water appropriations due to mine pit dewatering as well as the capture efficiency of the Category 1 Stockpile Groundwater Containment System. The MODFLOW model was not used to quantify groundwater drawdown at the Mine Site (Section 5.2.2.3.2 of Reference (1)); potential impacts to groundwater elevations from Mine Site appropriations are discussed in Section 8.1.2.1. The model met its calibration objectives and was reviewed and accepted during the environmental review process. Key conclusions of the modeling effort relevant to water appropriations included:

• Groundwater flow into the mine pits is estimated to increase from approximately 220 gallons per minute (gpm) to 870 gpm between Mine Year 1 and Mine Year 11 as the pits expand horizontally

and vertically. Groundwater flow into the East Pit is anticipated to begin decreasing in Mine Year 12 as the pit is backfilled with rock and flooded. Groundwater flow into the West Pit is expected to peak at Mine Year 11 and thereafter range from 40 gpm to 50 gpm.

• The Category 1 Stockpile Groundwater Containment System is capable of capturing 91% to more than 99% of the drainage from the Category 1 Waste Rock Stockpile (Attachment E to Reference (8)). The capture percentage of the containment system varies through time due to the influence of the mine pits on the groundwater gradients in the vicinity of the stockpile. The majority of the drainage not captured in the containment system eventually flows to the mine pits.

PolyMet also developed hydrologic models to estimate the run-on that will be collected by the Category 1 Stockpile Groundwater Containment System and the mine pit dewatering. These models include a probabilistic model of monthly and annual precipitation, evaporation, and runoff (the Mine Site GoldSim model, Section 5.2 of Reference (4)); and a calculation of runoff from design snowmelt events (Section 2.1 of Reference (3)). Runoff water will be collected along with the groundwater appropriations during mine pit dewatering and operation of the Category 1 Stockpile Groundwater Containment System.

5.2.1.5 Watershed Hydrology

PolyMet developed a hydrologic/hydraulic model for the Partridge River upstream of Colby Lake using XP-SWMM software (Sections 5.2.4.3 and 6.4 of Reference (4)). The purpose of the model is to evaluate the potential impacts of the Project on the Partridge River flows and stream morphology and on the Colby Lake and Whitewater Reservoir water levels. The XP-SWMM model is designed to estimate relative impacts to streamflow, as opposed to calculating future flows. That is, future flows are estimated based on observed flows scaled by the relative difference between an existing conditions XP-SWMM model and a future conditions XP-SWMM model.

The model was originally calibrated to U.S. Geological Survey (USGS) gage data on the Partridge River upstream of Colby Lake from water year 1985 and validated against the remainder of the 1978-1988 gage period. Since the initial model calibration, the USGS gage data has been modified to account for augmentation due to historical mine pit dewatering. The model met its calibration objectives and was reviewed and accepted during the environmental review process.

The results of the XP-SWMM model are discussed in Section 8.1.2.2 with respect to the impact of Mine Site appropriations on the hydrology of the Partridge River and Colby Lake.

5.2.2 Plant Site

Water appropriations at the Plant Site will be drawn from one hydrogeologic unit: the unconsolidated deposits (known as the "surficial aquifer", Section 5.2.2.1). The surficial aquifer and the field investigations performed for the Project are described in detail in the FEIS (Section 4.2.2.4.1 of Reference (4)) and Project documents (Section 4.3 of Reference (9)). See also the test hole data and long-term water level measurements, referenced in Section 5.2.2.2 of this application and hydrologic studies referenced in Section 5.2.2.3 of this application.

5.2.2.1 Plant Site Surficial Aquifer

The unconsolidated surficial deposits in the vicinity of the Plant Site are peat, glacial till, and reworked sediments. The existing LTVSMC tailings basin was constructed on top of these materials, which were used in starter dams in several locations before LTVSMC tailings deposition. Soil borings advanced through the LTVSMC tailings and into the underlying native materials reveal that the dominant till lithology underlying the LTVSMC tailings basin is an unsorted sandy loam with pebbles, cobbles, and boulders. Some areas are stratified, with lenses of sorted sediment. In places, the till is overlain by up to 10 feet of organic peat.

The thickness of surficial deposits (depth to bedrock) along the containment system alignment to the west, northwest, and north sides of the LTVSMC tailings basin ranges from 3.5 to 42.5 feet. The average thickness of surficial deposits along these alignments is 19.5 feet. Peat was encountered in some borings, ranging in thickness from less than a foot to several feet. No substantial surficial deposits are present along the southern and much of the eastern sides of the LTVSMC tailings basin, where the basin abuts bedrock. Surficial deposits underlie a portion of the alignment of the East Dam.

Most of the area between the existing LTVSMC tailings basin and the Embarrass River is covered by wetlands and minor surface water features. Unlike the ombrotrophic bogs at the Mine Site, where sphagnum peat has elevated the bog and reduced connection between the surface water and water table, the wetlands between the LTVSMC tailings basin and Embarrass River likely represent surficial expressions of the water table, and reflect, at least in part, groundwater and surface water flow from LTVSMC tailings basin seepage.

Field testing of the surficial deposits indicates a range of hydraulic conductivity values from 0.15 to 130 feet/day. The geometric mean conductivity of 4.4 feet/day is considered to be the best representation of in situ conditions in the glacial till surrounding the LTVSMC tailings basin (Section 4.2.2.4.1 of Reference (1).

5.2.2.2 Test Hole Data

Since 2008, a number of subsurface investigations have been conducted at the Plant Site to develop and refine the hydrogeologic models of the site. The investigations are summarized in Section 4.2.2.4.1 of Reference (4)). The investigations that are the most applicable to this appropriations permit are the geotechnical investigations performed in 2013/2014 to support the design of the FTB Seepage Containment System. Test hole locations, boring logs, and testing results from surficial and bedrock borings along the FTB Seepage Containment System alignment are provided in Attachment F of Reference (10).

In addition to subsurface testing associated with the FTB Seepage Containment System design, PolyMet has measured groundwater levels in the Plant Site surficial aquifer and the LTVSMC tailings basin at 28 locations for between 2 and 12 years each. Water level records are provided in Attachment A to Reference (9).

5.2.2.3 Hydrologic Studies

PolyMet developed a MODFLOW model of the Tailings Basin (Attachment A to Reference (9)), which was calibrated for existing conditions using measured groundwater elevations in the surficial aquifer and the LTVSMC tailings basin. This model is the basis for the estimated seepage rates from the Tailings Basin under existing conditions and with the Project. The estimated seepage under existing conditions, however, is understood to exceed the capacity of the surficial aquifer.

The quantity of water flowing through the saturated unconsolidated deposits in the vicinity of the Tailings Basin has been estimated based on observed hydraulic gradients and estimates of hydraulic conductivity and aquifer thickness. The saturated thickness of the surficial aquifer encountered in soil borings at the LTVSMC tailings basin toe averages approximately 23 feet. The thickness of the surficial aquifer increases to the north and northwest, as the thickness of the surficial deposits increase toward the Embarrass River. The estimated total groundwater flow through the aquifer downgradient of the LTVSMC tailings basin and toward the west, northwest, and north, is approximately 200 gpm (Table 5.2.2-37 of Reference (1)).

Because the seepage rate from the LTVSMC tailings basin exceeds the capacity of the surficial aquifer to transmit groundwater, the excess seepage upwells to the ground surface. As discussed in Section 5.2.1.4, the wetlands between the LTVSMC tailings basin and Embarrass River likely represent surficial expressions of the water table and reflect, at least in part, the flow from LTVSMC tailings seepage.

5.2.3 Colby Lake

Surface water will be withdrawn from Colby Lake, which is an in-stream lake within the Partridge River. The existing hydrology of Colby Lake is described in detail in the FEIS (Section 4.2.2 of Reference (1)) and summarized in Section 5.2.3.1 of this application. The FEIS also contains a detailed analysis of the effect of proposed withdrawals from Colby Lake (Section 5.2.2 of Reference (1)), which is summarized in Section 7.5.1 of this application. As required by Minnesota Rules, part 6115.0660, subpart 3(G)(1), a contingency plan is included as Section 5.2.3.2 of this application.

5.2.3.1 Hydrology

Colby Lake is located on the Partridge River approximately 8 miles southwest from the Mine Site and about 4 miles south of the Plant Site. It is mesotrophic and has a surface area of approximately 539 acres, and a maximum depth of approximately 30 feet (ft). The outlet control of Colby Lake is at an elevation of approximately 1,439 ft above mean sea level (amsl). The outflow from the lake stops when levels drop below this level.

Around 1955, in order to ensure a reliable source of water for mining, Erie Mining Company (predecessor to LTVSMC) constructed the Whitewater Reservoir and the diversion works, which connect Colby Lake and Whitewater Reservoir. DNR authorized construction of this reservoir and diversion works under a water appropriation permit (#1949-0135), which is currently held jointly by Cliffs Erie and Minnesota Power. The diversion works, which PolyMet understands is owned and operated by Minnesota Power, separate the two waterbodies and allow water to be exchanged between the two bodies of water. Whitewater Reservoir has a surface area of approximately 1,210 acres and a maximum depth of approximately 73 ft.

The existing water appropriation permit (#1949-0135) authorizes withdrawals from Colby Lake. Publicly-available information indicates when the former LTVSMC process plant was in operation, water management under permit #1949-0135 would typically result in water flowing through the diversion works gates from Colby Lake to Whitewater Reservoir during the spring runoff and then being pumped back into Colby Lake when needed. Permit #1949-0135 includes a condition that when water levels in Colby Lake fall below 1,439.0 ft amsl, the withdrawals of water from Colby Lake are limited to the rate that water can be pumped from Whitewater Reservoir to replace the water withdrawn. DNR's records indicate that since 2001, when LTVSMC ceased operating, the only actions under permit #1949-0135 have been Minnesota Power's maintenance activities of water levels between the Colby Lake and the Whitewater Reservoir and its maintenance activities of the dams associated with the Whitewater Reservoir in accordance with the permit.

Discharges from the Northshore Mine (Peter Mitchell Pit) also influence Colby Lake hydrology. The Northshore Mine, which is located at the headwaters of the Partridge River, is permitted to discharge up to 81 cfs to the Partridge River watershed under water appropriations permit #1982-2097. Discharges associated with pit dewatering have occurred since 1956 and are expected to continue until approximately 2070 (Section 4.2.2.2.2 of Reference (1)).

DNR records show that under relatively natural flows, in the 5-year period from January 2001 to December 2006 after LTVSMC stopped its water withdrawals and discharges from the Northshore Mine were only occurring sporadically, water levels in Colby Lake were higher with less fluctuation than when LTVSMC and its predecessors were withdrawing water for its mining operations. Over the same period, Whitewater Reservoir also experienced smaller fluctuations and higher average water levels than when the former LTVSMC facilities were operating.

There are two other water appropriation permits that authorize withdrawal of water from the Colby Lake-Whitewater Reservoir system. The City of Hoyt Lakes relies on the Colby Lake-Whitewater Reservoir system, withdrawing an annual average of 0.6 cfs from Colby Lake for municipal potable use and discharging an annual average of 0.5 cfs of treated wastewater effluent into Whitewater Reservoir under its water appropriation permit #1954-0036 (Section 6.2.2 of Reference (1)). Additionally, Minnesota Power withdraws cooling water from Colby Lake and discharges once-through non-contact cooling water back to Colby Lake with a permitted evaporative loss of 4.2 cfs under its water appropriation permit #1950-0172 (Section 6.2.2 of Reference (1)).

5.2.3.2 Colby Lake Appropriation Contingency Plan

Minnesota Rules, part 6115.0660, subpart 3(G)(1) require a permit applicant to describe the alternatives it would use if at any time appropriation were restricted to meet instream flow needs or to protect the level of a basin, or to agree to withstand the results of no appropriation.

The Whitewater Reservoir was constructed, in accordance with water appropriation permit #1949-0135, specifically to provide a reliable source of water for mining while also protecting Colby Lake levels and

Partridge River instream flow needs (Section 5.2.3.2). The Colby Lake-Whitewater Reservoir system uses "...water appropriated during high flows and levels and stored for later use." Water appropriation permit #1949-0135 also requires active water level management between Colby Lake and the Whitewater Reservoir and supplemental discharge requirements to the Partridge River based on water levels.

However, if at any time withdrawals from Colby Lake by all holders of water appropriation permits were to be restricted to meet in-stream flow needs or to protect the lake level in accordance with the requirements of Minnesota Statutes, chapter 103G and the related rules of DNR, PolyMet would agree to withstand the results of no water appropriation, in accordance with Minnesota Statutes, section 103G.285, subdivision 6, when called upon to do so along with other water appropriation permit holders of these surface waters. Notably, the need to impose such restrictions on any of the permitted users of Colby Lake water is unlikely because of the active water level management under water appropriation permit #1949-0135.

PolyMet intends to work with Minnesota Power and Cliffs Erie, as the joint permit holders of water appropriation permit #1949-0135, to develop a water management plan describing how water appropriations under PolyMet's Colby Lake water appropriation permit and activities by Minnesota Power and Cliffs Erie under water appropriation permit #1949-0135 will be collectively managed to meet the requirements of both water appropriation permits to minimize impacts to the water level in Colby Lake (primarily) and Whitewater Reservoir (secondarily) as necessary, as well as in the Partridge River.

5.3 Proposed Pumping Rates and Quantities

5.3.1 Methods to Estimate Proposed Pumping

Two methods were used to estimate pumping from appropriated sources: 1) results of probabilistic water modeling conducted for the FEIS, and 2) engineering estimates based on the area to be dewatered, the depth to the water table, typical soil properties, and pumping duration. Methods and assumptions for pumping estimates derived from probabilistic modeling are summarized in Section 5.3.1.1, and methods and assumptions for pumping estimates derived from engineering estimates are summarized in Section 5.3.1.2. Large Table 1 provides additional detail on pumping estimation assumptions and methods.

5.3.1.1 Probabilistic Water Modeling

Results of the probabilistic water modeling conducted for the FEIS were used to estimate pumping rates for the installations listed in Table 5-2. The FEIS Mine Site water model was run for a duration of 200 years using a monthly time step for 500 realizations (individual transient model runs with probabilistic inputs) (Reference (4)). For each month of the simulation, results are summarized for this application as the 90th percentile (P90) values. This indicates that for any given month, 90% of all model realizations are less than or equal to the P90 value. Results may be further summarized for a specific year of the simulation by taking the average or the maximum value of the monthly statistics.

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⁴ Minnesota Rules, part 6115.0660, subpart 3(G)(2)

The range of annual precipitation values used in the probabilistic water balance was developed based on the current 30-year climate normal period (1981-2010) and ranges from approximately 20 to 40 inches of precipitation per year (Section 5.2.1.1 of Reference (4)).

The Mine Site probabilistic model uses pit inflow rate estimated by the Mine Site MODFLOW model as the mean or most likely value of groundwater inflow. The uncertainty in the groundwater inflow rate is represented with a probability distribution that scales the model-estimated inflow values, based on examination of the model during the environmental review process. This log-normal distribution is defined such that the mean is the model-estimated value (scaling factor of 1.0) and the 95% confidence interval extends from approximately 0.75 to 2.0 times the model-estimated value. Because the probabilistic modeling incorporates uncertainty and variability, the P90 results were not multiplied by an additional "uncertainty factor" to obtain the pumping estimates.

The Plant Site probabilistic model estimates the amount of water that will be needed from Colby Lake, taking into account the uncertainty and variability in precipitation, seepage rates, and mine pit dewatering.

The dewatering pumping schedule for the installations listed in Table 5-2 was based on the Project schedule as presented in the FEIS and is still relevant for permitting and planned operations.

Table 5-2 Probabilistic Model Results used to Estimate Pumping Rates

Individual Permit	Installation	Values used for pumping estimate
East Pit	East Pit Sump	P90 monthly groundwater inflow P90 monthly net precipitation
Central Pit	Central Pit Sump	P90 monthly groundwater inflow P90 monthly net precipitation
West Pit	West Pit Sump	P90 monthly groundwater inflow P90 monthly net precipitation
Mine Site Infrastructure	Operation of the Category 1 Stockpile Groundwater Containment System	P90 monthly total inflow
Colby Lake	Colby Lake Pumphouse	P90 monthly total pumping rates

5.3.1.2 Engineering Estimates

The total amount to be pumped during construction dewatering was calculated using information such as construction area, depth of excavation, approximate depth to water table, typical material properties, assumed construction method, and the preliminary construction schedule. Pumping amounts for construction dewatering are order-of-magnitude estimates that include both groundwater and precipitation. Uncertainty factors were applied to the calculated amounts, based on the level of uncertainty associated with the various components of the engineering estimate, as detailed in

Large Table 1. Engineering estimates are the basis of total pumping volumes for the following installations:

- mine pit overburden stripping (East, Central, and West Pits)
- mine water pond construction (Mine Site Infrastructure)
- stormwater infrastructure construction (Mine Site Infrastructure and Plant Site Infrastructure)
- Category 1 Stockpile Groundwater Containment System construction (Mine Site Infrastructure)
- stockpile foundation, sump, and overflow pond construction (Mine Site Infrastructure)
- Ore Surge Pile foundation, sump, and overflow pond construction (Mine Site Infrastructure)
- stockpile underdrain operation (Mine Site Infrastructure)
- construction of new buildings (Mine Site Infrastructure)
- FTB Seepage Containment System construction⁵ (Plant Site Infrastructure)
- Sewage Treatment System construction (Plant Site Infrastructure)
- HRF foundation construction (Plant Site Infrastructure)
- HRF wick drain construction and operation (Plant Site Infrastructure)
- Colby Lake pipeline upgrades (Plant Site Infrastructure)
- Miscellaneous construction dewatering (Mine Site Infrastructure and Plant Site Infrastructure)
- Secondary uses for make-up water from Colby Lake

5.3.1.3 Maximum Daily, Monthly, and Annual Pumping Rates

For each of the individual permits, PolyMet summed the estimated pumping rates of all installations included in the permit on a monthly basis, according to the schedule set out in the FEIS and the preliminary construction schedule. The maximum monthly pumping rate was identified as the highest of all summed monthly pumping rates. As a conservative estimate, the maximum annual pumping rate was set equal to the maximum monthly pumping rate. For the Individual Permits for the mine pits, the maximum daily pumping rate was also set equal to the maximum monthly pumping rate. For the Mine Sit Infrastructure and Plant Site Infrastructure Permits, the maximum daily pumping rate was derived from short-term construction dewatering that lasts less than one month. When the preliminary construction schedule shows multiple short-term dewatering installations occurring in the same month, the estimate conservatively assumes that they occur concurrently.

⁵ Conservatively assuming open trench construction methods. In-situ construction methods would result in less pumping.

5.3.2 Pumping Rates and Quantities

Table 5-3 summarizes estimated pumping rates and quantities for each Individual Permit. Pumping rates include both the flow of appropriated groundwater and the flow of water that originates as precipitation. In practice, these flows cannot be physically separated. During operations, flow monitoring will record the total flow, and PolyMet will pay the appropriations fee for the entire recorded volume pumped under the Individual Permits, despite the fact that some fraction of that water is precipitation.

For the Mine Site Infrastructure Permit and the Plant Site Infrastructure Permit, which each include multiple installations, the maximum daily pumping rate and the total pumped quantity estimated for each installation are itemized in Table 5-4 and Table 5-5, respectively.

Table 5-3 Estimated Pumping Summary: by Individual Permit

Individual Permit	Maximum Daily Rate ⁽¹⁾ (gpm)	Maximum Monthly Rate ⁽¹⁾ (gpm)	Maximum Annual Rate ⁽¹⁾ (gpm)	Maximum Annual Volume (MG)	Average Annual Rate ⁽³⁾ (gpm)
East Pit	1,900 ⁽⁴⁾	1,900(2)	1,900(5)	1,000(6)	200 – 800
Central Pit	1,300 ⁽⁴⁾	1,300 ⁽²⁾	1,300 ⁽⁵⁾	675 ⁽⁶⁾	50 – 250
West Pit	1,500 ⁽⁴⁾	1,500 ⁽²⁾	1,500 ⁽⁵⁾	800(6)	150 – 550
Mine Site Infrastructure	5,050 ⁽⁷⁾	1,800 ⁽²⁾	1,800 ⁽⁵⁾	950 ⁽⁸⁾	50 – 500
Plant Site Infrastructure	3,750 ⁽⁷⁾	1,300 ⁽²⁾	1,300 ⁽⁵⁾	500 ⁽⁸⁾	250 – 300
Colby Lake	3,400 ⁽⁴⁾	3,400 ⁽⁹⁾	3,400 ⁽⁵⁾	1,800(6)	550-2,000

Note: Pumping rates include appropriated groundwater along with stormwater runoff and precipitation. In practice, it will not be practical to split the contribution of appropriated groundwater with runoff and precipitation.

- Maximum daily, monthly, and annual pumping rates for the Individual Permits occur in different time periods. Rates cannot be summed.
- (2) Highest monthly value of all installations included in permit have been combined: P90 for pit dewatering and operation of the Category 1 Stockpile Groundwater Containment System; engineering estimate for other installations with uncertainty factors applied and rounded up to the nearest 50 pgm.
- (3) Range of the average monthly P50 values, on an annual basis, over the years of the appropriation, plus any appropriations associated with scheduled overburden stripping, rounded up to the nearest 50 gpm. This information is provided for context.
- (4) Maximum daily rate set equal to maximum monthly rate, because mine pit rates are estimated in GoldSim on a monthly
- (5) To be conservative, maximum annual rate is set equal to maximum monthly rate.
- (6) Maximum annual volume is calculated from the maximum annual rate.
- (7) Maximum daily rate is driven by short-term construction dewatering that lasts less than one month. To be conservative, all short-term dewatering installations scheduled for a given month are assumed to occur concurrently.
- (8) To be conservative, maximum annual volume is calculated from the maximum annual rate or set equal to the permit total volume, whichever is lower.
- (9) Maximum monthly rate includes P90 Goldsim estimate of primary make-up water demands, and engineering estimates of other make-up water demands, See Table 5-6 for details.

Table 5-4 Estimated Pumping by Installation: Mine Site Infrastructure Permit

Installations	Pumping schedule	Maximum Daily Rate ⁽¹⁾ (gpm)	Total Volume ⁽²⁾ (MG)
Ore Surge Pile foundation, sumps, and overflow ponds construction	Intermittent during pre-operation construction	150	5
Construction of new buildings	Intermittent during pre-operation construction	100	10
Mine water pond construction	Intermittent, pre-operation construction to Mine Year 6	200	30
Stormwater pond construction	Intermittent, pre-operation construction to Mine Year 2	700	35
Category 4 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction to Mine Year 3	800	25
Category 2/3 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	Intermittent, pre-operation construction to Mine Year 6	1,450	120
Category 1 Waste Rock Stockpile foundation construction	Intermittent, Pre-operation construction to Mine Year 6	3,400	40
Category 1 Stockpile Groundwater Containment System construction	Intermittent, pre-operation construction to Mine Year 5	300	70
Category 1 Stockpile Groundwater Containment System operation	Continuous, Mine Years 1 to 21	700	3,120
Category 2/3 Waste Rock Stockpile underdrains, if needed	Continuous, Mine Years 1 to 19	50	190
Category 4 Waste Rock Stockpile underdrains, if needed	Continuous, Mine Years 1 to 11	25	45
Ore Surge Pile underdrains, if needed	Continuous, Mine Years 1 to 20	25	90
Miscellaneous construction dewatering	Intermittent as needed	100	20
	Total Mine Site Infrastructure	N/A ⁽³⁾	3,800(4)

Note: Pumping rates and volumes include appropriated groundwater along with stormwater runoff and precipitation. In practice, it will not be practical to split the contribution of appropriated groundwater with runoff and precipitation.

⁽¹⁾ Maximum daily rate from engineering estimate for temporary construction dewatering with uncertainty factor applied, rounded up to nearest 25 gpm.

⁽²⁾ Engineering estimate of volume for temporary construction dewatering with uncertainty factor applied, rounded up to nearest 5 MG,

⁽³⁾ Maximum daily rates for the individual installations occur in different time periods. Rates cannot be summed. Maximum daily rate is driven by short-term construction dewatering that lasts less than one month. To be conservative, all short-term dewatering installations scheduled for a given month are assumed to occur concurrently.

⁽⁴⁾ Total volume rounded up to the nearest 25 MG.

Table 5-5 Estimated Pumping by Installation: Plant Site Infrastructure Permit

Installations	Pumping schedule	Maximum Daily Rate ⁽¹⁾ (gpm)	Total Volume ⁽²⁾ (MG)
Flotation Tailings Basin (FTB) Seepage Containment System construction dewatering	Intermittent, pre-operation construction and Mine Year 7	3,350	300
Sewage Treatment System construction dewatering	Pre-operation construction	100	5
Hydrometallurgical Residue Facility (HRF) construction dewatering, if needed	Intermittent, pre-operation construction to Mine Year 3	2,850	130
HRF wick drain operation, if needed	Mine Year 1 through 20	150	35
Colby Lake pipeline upgrades (construction dewatering)	Pre-operation construction	300	15
Miscellaneous construction dewatering	Intermittent as needed	100	15
Total Plant Site Infrastructure		N/A ⁽³⁾	500 ⁽⁴⁾

Note: Pumping rates and volumes include appropriated groundwater along with stormwater runoff and precipitation. In practice, it will not be practical to split the contribution of appropriated groundwater with runoff and precipitation.

- (1) Maximum daily rate from engineering estimate for temporary construction dewatering with uncertainty factor applied, rounded up to nearest 25 gpm.
- (2) Engineering estimate of volume for temporary construction dewatering with uncertainty factor applied, rounded up to nearest 5 MG.
- (3) Maximum daily pumping rates for the individual installations occur in different time periods. Rates cannot be summed. Maximum daily rate is driven by short-term construction dewatering that lasts less than one month. To be conservative, all short-term dewatering installations scheduled for a given month are assumed to occur concurrently.
- (4) Total volume rounded up to the nearest 25 MG.

Table 5-6 Estimated Colby Lake Make-Up Water Demand

Make-Up Water Use	Maximum Monthly Rate (gpm)
Primary Water Uses	
Process ore; supplement the hydrometallurgical process; provide stream augmentation; aid in maintaining water levels in the Tailings Basin	3,150 ⁽¹⁾
Secondary Water Uses ⁽²⁾	
Potable water use	50 ⁽³⁾
Dust control	100(3)
Air emission control scrubber systems	50 ⁽³⁾
Miscellaneous water demand	50 ⁽³⁾
Total Colby Lake Make-Up Water Demand	3,400

⁽¹⁾ P90 Goldsim monthly rate, rounded up to the nearest 25 gpm

5.3.3 Methods of Appropriation

Method of appropriation will vary by installation. Mine pit overburden stripping dewatering will occur via separate mobile pumping systems prior to pit development; flow from stripping may be directed to the mine pit collection sumps once the sumps are constructed.

Water management within the pits (see Section 2.1.3 of Reference (4)) will occur as part of mine development, with the pit floors sloped toward collection sumps. The sumps will be excavated as part of mine operations. Pumps in the sumps will either be submersible pumps or pumps on a raft floating in the sump. Hoses will connect the pumps to pipes which may connect to additional pumps at the rim of the pits conveying the water for treatment. The size and location of the sumps and pumps will change as the pits expand in size and depth, requiring periodic evaluation of the pumping system. The pumping system capacities will be designed to handle groundwater inflows and the average annual runoff volumes from a snowmelt event (Section 2.1.3 of Reference (3)). Flow meters will be installed to track pumped rates and volumes from the mine pit collection sumps.

The Category 1 Stockpile Groundwater Containment System (Section 2.1.2 of Reference (8)) will consist of a cutoff wall (a low permeability compacted soil hydraulic barrier) combined with a drainage collection system around the perimeter of the stockpile near the stockpile toe. The final configuration of the containment system will completely encircle the stockpile. Stockpile drainage collected in the drain pipes will flow by gravity to a collection sump where it will be pumped to the WWTF. Collection sumps will have emergency overflows to the East or West Pits. Flow meters will be installed to track pumped rates and volumes from the collection sumps to the WWTF.

⁽²⁾ There are a few additional secondary water uses that are non-consumptive, such as gland seal water, which require water, but do not consume water. There are a few additional secondary uses that are not annual uses, such as fire water and water required for the startup of Tailings Basin operations that are not listed in this table of annual use, but that are accounted for in the estimated maximum monthly rates.

⁽³⁾ Engineering Estimate, rounded up to the nearest 25 gpm

If stockpile underdrains are needed, the water collected would flow by gravity to underdrain sumps, and then be pumped for treatment on-site or off-site as determined through the NPDES/SDS permitting process.

Construction dewatering (under the Mine Site Infrastructure Permit and the Plant Site Infrastructure Permit) will be accomplished via temporary dewatering wells and movable pumps and piping. Most construction dewatering will be groundwater dewatering; however run-on and standing water may be pumped from construction areas, if needed. Pumping of standing water is anticipated only for construction of the FTB Seepage Containment System and the HRF foundation.

Colby Lake pumping will occur from the existing Colby Lake Pumphouse and associated equipment, which will pump water to the Plant reservoir via the existing pipeline. A flow meter will track pumped rate and volume.

5.4 Alternatives Considered

The objective of all proposed appropriations is to construct and operate Project features below the water table, with three exceptions, which are described below. Dewatering is the only alternative available to accomplish this objective. By using water appropriated for mineral processing, PolyMet will limit the need to appropriate water from other sources.

The objective of the Category 1 Stockpile Groundwater Containment System is to limit potential groundwater impacts from the Project's only permanent stockpile. During the environmental review process, this option was determined to be the preferred alternative to accomplish this objective (Section 3.2.3.3 of Reference (1)).

The objective of the underdrains on temporary waste rock stockpiles and the temporary Ore Surge Pile and HRF wick drains, if they are needed, is to support the integrity and performance of the liner systems, which will limit potential groundwater impacts from the Project's temporary stockpiles, Ore Surge Pile and the HRF. The underdrains may be necessary under both the stockpiles and the associated sumps and ponds. There are alternative ways to construct the foundation systems of these infrastructure, but, use of underdrains and wick drains for foundation drainage, if needed, are the preferred methods to accomplish the desired objective.

The objective of pumping from Colby Lake is to provide make-up water, as needed, to the Plant Site. Uses of make-up water are described in Section 3.0. The primary alternative to appropriation of water from Colby Lake would be to recycle more of the captured seepage from the Tailings Basin for use as process water; however, this alternative was rejected because it would decrease the quantity of water available for stream augmentation. Stream augmentation was identified in the environmental review process as an important activity to limit potential hydrologic and ecologic impacts of the Project to downstream water resources at the Plant Site, and pumping from Colby Lake is critical to maintaining an adequate supply for stream augmentation (Sections 5.2.2. and 5.2.6 of Reference (1)). The selected alternative is consistent with the use prioritization requirements of Minnesota Rules, part 6115.0660, subpart 3(G)(2), which requires that "alternatives for appropriating water have been considered including use of water appropriated

during high flows and levels and stored for later use, and the use of groundwater." Proposed Project appropriations are consistent with these priorities. Water will be drawn from the Colby Lake-Whitewater Reservoir system, which was constructed specifically to provide a stable water supply for mining by storing water during high flows for later use. In addition, the Project will meet more than 80% of its water demand using groundwater appropriated for dewatering necessary to conduct mining operations.

6.0 Additional Requirements and Conditions for Dewatering (Minnesota Rules, part 6115.0710)

6.1 Reasonable Necessity for Dewatering (Minnesota Rules, part 6115.0710 (A))

All proposed dewatering covered by the five Individual Permits at the Mine Site and Plant Site is necessary to construct and operate the Project. Implementation of PolyMet's proposal for dewatering is practical and consistent with standard industry practice.

6.2 Excess water can be discharged without adversely affecting the public interest in the receiving waters (Minnesota Rules, part 6115.0710 (B))

The discharge destination will vary by installation, as indicated on Table 6-1.

Most water withdrawn under the four Mine Site Individual Permits will be discharged to the FTB, from where it will be recycled for use in mineral processing. Water used in mineral processing will be routed to the FTB and some may eventually emerge as seepage from the FTB, which will then be collected, treated, and discharged as treated effluent from the WWTP as authorized under the terms of an NPDES/SDS permit for the Project.

PolyMet has evaluated potential effects of the discharge from the WWTP, (Section 8.1.2.3) and determined that the discharge will not cause exceedances of any applicable State surface water quality standards (Section 6.5 of Reference (4) and Section 6.7 of Reference (9)). Furthermore, the carrying capacity of the outlet to which waters will be discharged is adequate. The discharge quantity will be managed to "replace" water that is captured by the FTB seepage capture systems, in order to avoid adverse ecologic and hydrologic impacts to the receiving waters that could result from operation of the NorthMet FTB seepage capture systems (Section 3.3).

Some dewatering installations under the Mine Site Infrastructure Permit and the Plant Site Infrastructure Permit will be discharged off-site under the terms of an MPCA construction stormwater permit and associated SWPPPs prepared in accordance with the NPDES/SDS Construction Stormwater General Permit (R1000001), using best management practices to prevent adverse water quality, hydrologic, or ecologic effects.

Therefore, discharge of appropriated water will not negatively affect the public interest in the receiving waters.

 Table 6-1
 Dewatering Discharge Destination, by Installation

Individual Permit	Installation	Dewatering Discharge Destination ⁽¹⁾
F D''	Overburden stripping	Flotation Tailings Basin (FTB)
East Pit	East Pit Sump	FTB
C + 10"	Overburden stripping	FTB
Central Pit	Central Pit Sump	FTB
Mark Dit	Overburden stripping	FTB
West Pit	West Pit Sump 1 and Sump 2	FTB
	Ore Surge Pile foundation, sumps, and overflow ponds construction	FTB
	Construction of new buildings	FTB or off-site
	Mine water pond construction	FTB or off-site
	Stormwater pond construction	FTB or off-site
	Category 4 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	FTB
Mine Site	Category 2/3 Waste Rock Stockpile foundation, sumps, and overflow ponds construction	FTB
Infrastructure	Category 1 Waste Rock Stockpile foundation construction	FTB
	Category 1 Stockpile Groundwater Containment System construction	FTB
	Category 1 Stockpile Groundwater Containment System operation	FTB
	Category 2/3 Waste Rock Stockpile underdrains, if needed	FTB or off-site
	Category 4 Waste Rock Stockpile underdrains, if needed	FTB or off-site
	Ore Surge Pile underdrains, if needed	FTB or off-site
	Miscellaneous construction dewatering	FTB or off-site
	FTB Seepage Containment System construction	FTB or off-site
	Sewage Treatment System construction	Off-site
Plant Site	Hydrometallurgical Residue Facility (HRF) construction	FTB or off-site
Infrastructure	HRF wick drains, if needed	FTB or Waste Water Treatment Plant (WWTP)
	Colby Lake pipeline upgrades	Off-site
	Miscellaneous construction dewatering	FTB or off-site

⁽¹⁾ PolyMet will provide Minnesota Department of Natural Resources more precise discharge locations during permitting.

6.3 Proposed Dewatering is Not Prohibited by Any Existing Law (Minnesota Rules, part 6115.0710 (C))

No existing law prohibits the proposed dewatering under any of the five Individual Permits.

7.0 Additional Requirements and Conditions for Mining and Processing (Minnesota Rules, part 6115.0720)

7.1 Plans and Specifications (Minnesota Rules, part 6115.0720, subpart 1(A))

Construction plans have been developed based on the permit-level design with associated specifications incorporated. This permit-level design has been used to determine the required withdrawal of waters of the state for construction and operations. The use, storage, and disposal of waters of the state are described in this permit application in Sections 6.2 and 7.2 and shown in permit-level designs of the FTB, WWTF, and WWTP. Construction plans are attached in Appendix C for the following features:

- Mine Site and Dunka Road Earthwork Permit Application Support Drawings
- Category 1, 2/3, and 4 Stockpiles and Ore Surge Pile Design Permit Application Support Drawings
- Mine Site Mechanical Infrastructure Permit Application Support Drawings
- Mine Site Stormwater Permit Application Support Drawings
- Plant Site Stormwater Permit Application Support Drawings
- Category 1 Stockpile Groundwater Containment System Permit Application Support Drawings
- FTB Seepage Containment and Stream Augmentation Systems Permit Application Support Drawings
- Hydrometallurgical Residue Facility Permit Application Support Drawings
- Flotation Tailings Basin Permit Application Support Drawings
- Waste Water Treatment Facility Permit Application Support Drawings
- Waste Water Treatment Plant Permit Application Support Drawings

Other engineering design drawings, including construction level details for buildings, the Sewage Treatment Systems, and Colby Lake pipeline repairs will not be completed until further geotechnical investigations are completed. The construction dewatering estimated for these systems, as provided in this application have been adequately estimated for those features.

7.2 Consumption of Appropriated Water in Mineral Processing (Minnesota Rules, part 6115.0720, subpart 1(B))

Appropriated water that is sent to the FTB (Table 6-1) will be used for mineral processing. The water will be recirculated between the FTB and the Beneficiation Plant, with relatively small losses due to evaporation within the plant and water in the concentrate product. Water will be lost during mineral processing at the Beneficiation Plant at an average rate of approximately 48 gpm (Section 2.1.1 of Reference (2)).

There will also be minor losses of appropriated water associated with waste water treatment, from the following processes:

- Operation of the WWTF will result in a loss of approximately 5 gpm in the chemical precipitation sludge (Section 6.1.2.4 of Reference (4)).
- Seepage and evaporation loss from the double-lined WWTF equalization basins will be minimal and will total less than 0.1 gpm (Section 6.1.2.4 of Reference (4)).
- Operation of the WWTP will not result in a loss of appropriated water during operations, because all non-effluent water (filter backwash and reject concentrate) will be returned either to the FTB Pond or to the WWTF (Section 6.1.4 of Reference (9)).

7.3 Criteria Used for Estimating Appropriations (Minnesota Rules, part 6115.0720, subpart 1(C))

Criteria used for estimating appropriation rates for the water withdrawn under the five Individual Permits, including information on climatic data and uncertainty, are presented in Section 5.3.

7.4 Details of Water Released (Minnesota Rules, part 6115.0720, subpart 1(D))

Information regarding the source, rate, and volume of water released from the Project via the WWTP is discussed in Section 3.4. Water from some dewatering installations may be discharged off-site under terms of an MPCA construction stormwater permit and associated SWPPPs. Estimates of the source, rate, and volume of water that may be released off-site (installations noted on Table 6-1) are provided in Table 5-4 and Table 5-5 for the Mine Site and the Plant Site, respectively.

7.5 Hydrologic and Hydraulic Impacts (Minnesota Rules, part 6115.0720, subpart 1(E))

PolyMet assessed potential hydrologic and hydraulic impacts in the Partridge River watershed and the Embarrass River watershed due water appropriations and other aspects of Project operations. The findings of this assessment are summarized below.

7.5.1 Potential Effects on the Partridge River and Colby Lake

Project actions that could cause hydrologic effects to the Partridge River and Colby Lake are the operation of the South Seepage Management System at the Plant Site, watershed area changes at the Mine Site, and appropriation of surface water from Colby Lake. Each of these actions were addressed during the environmental review process, and the major conclusions from the FEIS are summarized below.

- The South Seepage Management System will intercept seepage from the Tailings Basin that has
 historically flowed to Second Creek, a tributary of the Partridge River; however, stream
 augmentation downstream of this system will minimize hydrologic and hydraulic impacts to
 Second Creek, as described in Section 3.3.
- The XP-SWMM model for the Partridge River (see Section 5.2.1.5 of this application) was used to evaluate the effects on stream flow from watershed area changes (Section 5.2.2.3.2 of Reference (1)). Key conclusions of the modeling effort include:

- The primary difference between existing conditions and future conditions as estimated in the XP-SWMM models is the resulting change in the total tributary area to the Partridge River as Mine Site development alters subwatershed divides and diverts runoff for treatment. The total watershed area tributary to each model output location during future conditions ranges from 94% to 99% of the existing-conditions watershed area.
- o Basic statistics characterizing flow patterns at different locations along the Partridge River during Project operations indicate that average and high flows will change by less than 10% throughout the stages of Mine Site development. The changes in average and high flows will be greatest in the vicinity of the Mine Site but decrease to less than 5% below the confluence of the Partridge River with the South Branch of the Partridge River (SW004a) and less than 3% immediately upstream of Colby Lake (SW006). Low flows will decrease by less than 10%.
- The FEIS assessed the potential effects of Project withdrawals from Colby Lake on water levels in Colby Lake and the Whitewater Reservoir. The FEIS assessed an average pumping rate of 3,500 gpm for Project appropriations from Colby Lake. At a 3,500 gpm withdrawal rate and average flow conditions associated with that withdrawal, the average Colby Lake drawdown attributable to the Project is estimated to be 0.01 ft, with an average annual water level fluctuation of about 3.6 ft, compared to 3.9 ft for zero withdrawal. Whitewater Reservoir would also be affected by water withdrawals for the Project, as it is used to help maintain water levels in Colby Lake as described in Section 5.2.3 of this application. Under this 3,500 gpm withdrawal and average flow conditions scenario, drawdown on Whitewater Reservoir that would be attributable to the Project is predicted to be about 0.4 ft with a maximum annual fluctuation of about 4.2 ft, compared to about 2.9 ft for zero withdrawal (Section 5.2.2 of Reference (1)). Effects of the appropriation rate requested in this application would be similar to the effects estimated for the FEIS (3,500 gpm evaluated in the FEIS, and 3,400 gpm requested in this water appropriation application).

Overall, these results demonstrate that the Project is expected to have minimal hydrologic and hydraulic effects on the Partridge River watershed, including Colby Lake. There are no anticipated hydrologic or hydraulic impacts that would preclude issuing the relevant Individual Permits for the Partridge River watershed under the applicable Minnesota statutes or rules.

7.5.2 Potential Effects on the Embarrass River

PolyMet will minimize hydrologic and hydraulic impacts to the Embarrass River by managing excess water in a manner that complies with the requirements of Minnesota Rules, part 6115.0720, subpart 2(C). Specifically, PolyMet will use the water management strategy referred to as stream augmentation, as described in Section 3.3, to address potential reductions in stream flow resulting from the FTB seepage capture systems. The rate of discharge from the WWTP to tributaries of the Embarrass River will be managed so that the average annual flow in receiving waters is maintained at ±20% of existing conditions. The MDNR, in response to comments on the FEIS, stated that "Moderate changes to flow within these systems are expected to be protected by riparian vegetation, and these reaches are expected

to be stable under moderate changes to stream flow and sediment supply." (p. A-335 of Reference (1)). Discharges from the WWTP also will meet State water quality standards imposed under the Project's NPDES/SDS permit. Therefore, the discharge from the WWTP is not expected to cause adverse hydrologic or hydraulic effects in the receiving waters of the Embarrass River and will be in compliance with applicable Minnesota statutes and rules.

7.5.3 Potential Effects Due to Drawdown

7.5.3.1 Mine Site

Water levels at the Mine Site will be drawn down due to pit dewatering. At the Mine Site, the FEIS concluded that due to the heterogeneity of the Mine Site surficial aquifer, and based on previous studies of mine pits in northeastern Minnesota, it was not reasonable to attempt to quantify drawdown at the Mine Site using the MODFLOW model (Section 5.2.2.3.1 of Reference (1)). Therefore, an analog study was performed using data from the Canisteo Pit as well as the Minntac West Pit, which are located 70 and 29 miles from the Mine Site, respectively. Based on the analog site evaluation, the FEIS reached the following conclusions with respect to potentially measurable drawdown at the Mine Site:

- 0 to 1,000 feet from the pit rim: groundwater drawdown from pit dewatering may occur and may be measurable;
- 1,000 to 1,700 feet from the pit rim: groundwater drawdown from pit dewatering may occur, but may be difficult to distinguish from natural variations in background water levels;
- 1,700 to 3,200-plus feet from the pit rim: groundwater drawdown from pit dewatering may occur, but would likely only occur under certain hydrogeologic conditions, and may not be discernible from natural variability; and
- Beyond 3,200 feet from the pit: no drawdown effects would be expected.

There are few surface water bodies within the 0- to 1,000-foot zone or the 1,000- to 1,700-foot zone surrounding the Mine Site pit rims where groundwater drawdown may occur and would potentially be distinguishable from natural variations. Potentially impacted surface waters within these first two zones include Unnamed (West Pit Outlet) Creek and the headwaters of the Partridge River. The proposed Category 1 Stockpile Groundwater Containment System, with its low-permeability cutoff wall keyed into bedrock, would minimize effects of pit drawdown on the headwaters of the Partridge River.

The potential indirect impacts on wetlands due to change in wetland hydrology from groundwater drawdown at the Mine Site were assessed in the FEIS using the results of the analog site evaluation and consideration of wetland type and connection to groundwater (Section 5.2.3.2.2 of Reference (1)). Potentially impacted wetlands within the first two analog zones include portions of One Hundred Mile Swamp, to which impacts would be minimized by the proposed Category 1 Stockpile Groundwater Containment System and its low-permeability cutoff wall keyed into bedrock. As part of its wetland monitoring plan developed as part of the federal and state permitting process, PolyMet will conduct monitoring of wetland hydrology and vegetation communities to document the extent and magnitude of

wetland responses, if any (potential indirect effects), from disturbances related to the Project. In particular, wetlands that have a higher potential for indirect effects as a result of groundwater drawdown will be monitored in accordance with the wetland monitoring plan.

7.5.3.2 Plant Site

At the Plant Site, potential drawdown from construction dewatering at the Plant Site will be temporary and localized to the areas immediately adjacent to the construction areas, and any potential drawdown from the use of the HRF wick drains, if needed, will be localized to the area immediately below the HRF. Water that is currently flowing to the wetlands north and west of the LTVSMC tailings basin will be managed in accordance with an MPCA construction stormwater permit and associated SWPPP. No hydrologic or hydraulic effects are expected at the Plant Site as a result of the construction dewatering activities or the dewatering from the HRF wick drains, if they are used.

7.6 Prioritization of Water Supply Sources and Other Mining-Specific Requirements

Minnesota Rules part 6115.0720 subpart 2(A and B) directs the applicant to use available surplus water from mining operations or facilities, and to prioritize water supply sources based on various criteria. The water appropriations PolyMet is requesting under the terms of the five Individual Permits will consist entirely of surplus water generated by dewatering that is necessary for mining operations. Water from these dewatering installations will be primarily conserved through recycling within the Project facilities and operations, with some treated effluent used for stream augmentation purposes as described in Sections 3.3 and 7.5.2 of this application. Project water uses and appropriations installations are consistent with the top two priority water supply sources under Minnesota Rules, part 6115.0720 subpart 2(B): 1) runoff from the mining areas, and 2) water from active mine pits and tailing basins.

Minnesota Statutes, section 103G.297 contains additional provisions applicable to mining activities. These provisions include requirements that the proposed use of waters:

- will be necessary for the mining of deposits of ore, and another more feasible and economic method of mining the ore is not reasonably available;
- will not substantially impair the interests of the public in, or beneficial public uses of, lands or waters except as authorized by permit;
- will not endanger public health or safety; and
- will be in the public interest, and the proposed public benefits will warrant the proposed water use

The Project has met these requirements of Minnesota Statutes, section 103G.297, as documented in the review of alternatives, potential economic and social effects, and cumulative impacts of the FEIS (Reference (1)). Also, the more detailed discussions in the other sections of this application provide further support for the MDNR commissioner's determinations under Minnesota Statues Section 103G.297.

7.7 Restoration of Surface Water Flow

Minnesota Rules part 6115.0720 subpart 2(C) calls for the permittee to manage discharge of appropriated water in a manner that will restore the flow in areas where a mining operation will cause reductions in watercourse flow. Stream augmentation at the Plant Site, as described in Section 3.3 and Section 7.5.2, will restore the flow to Unnamed (Mud Lake) Creek, Trimble Creek, Unnamed Creek, and Second Creek that would otherwise be reduced by operation of the FTB seepage capture systems.

8.0 Compliance with Sustainability and Water Supply Management Requirements

The overall Project water appropriations permitting approach is designed to meet the State groundwater sustainability standard (Minnesota Statutes, section 103G.287 subdivision 5), applicable water supply management requirements of the State of Minnesota (Minnesota Statutes, section 103G.265), and other State and local plans related to water appropriations.

8.1 Groundwater Sustainability Standard

The FEIS concluded that the Project is not expected to have a significant effect on groundwater hydrology in the Partridge River or Embarrass River watersheds (Sections 5.2.2.3.2 and 5.2.2.3.3 of Reference (1)). This permit application builds upon that analysis. The following subsections demonstrate that the proposed groundwater appropriations are sustainable to continue to supply the needs of future generations and will not harm ecosystems, degrade water, or reduce water levels beyond the reach of public water supply and private domestic wells. Thus, PolyMet's proposed appropriations will comply with Minnesota's groundwater sustainability standard from Minnesota Statutes, section 103G.287 subdivision 5.

8.1.1 Groundwater Appropriations are Sustainable

Groundwater resources that could be affected by the Project are the Mine Site surficial aquifer and bedrock in the Partridge River watershed and the Plant Site surficial aquifer, which is primarily in the Embarrass River watershed, with a small section in the Partridge River watershed, as described in Section 5.2.

The Mine Site surficial aquifer, like most glacial aquifers in the region, is generally thin, discontinuous, and limited in yield (Reference (11)). The dewatering at the Mine Site is expected to result in relatively localized effects on the Mine Site surficial aquifer, as described in Section 7.5.3.1. No private wells have been identified that pump from the surficial aquifer in the vicinity of the Mine Site.

The only bedrock unit that is considered to be an aquifer in the vicinity of the Project is the BIF, which serves as a source of municipal water supply for some Iron Range cities (Reference (11)). Mine Site pit dewatering will draw water from the Duluth Complex and the Virginia Formation, bedrock units which are not used for water supply in the area (Reference (11)). The mine pits will not extend into the BIF, thus dewatering is not expected to affect the BIF (Section 3.2.4 of Reference (12)).

The Plant Site surficial aquifer, similar to the surficial aquifer at the Plant Site, is a glacial aquifer that is generally thin, discontinuous, and limited in yield (Reference (11)). The temporary construction dewatering and the dewatering from the HRF wick drains, if needed, at the Plant Site are expected to result in highly localized effects on the Plant Site surficial aquifer, as described in Section 7.5.3.2. This will minimize the potential for Project water appropriations from the Plant Site surficial aquifer to affect downgradient users of groundwater.

In summary, the effects of the proposed appropriations on groundwater resources are not expected to negatively affect the groundwater supply in the Partridge River watershed or the Embarrass River watershed.

8.1.2 Effects on Ecosystems

PolyMet also assessed the potential for impacts to ecosystems due to drawdown associated with water appropriations, hydrologic changes, and discharges from the Project. The results of that assessment are presented below.

8.1.2.1 Effects Due to Drawdown

Although drawdown of the water table associated with water appropriations is not anticipated to be significant and is not expected to impact aquatic ecosystems by lowering water levels in surface water bodies and wetlands, there is some potential for such an impact. This issue was addressed during the environmental review process. PolyMet will conduct monitoring during Project construction and operations as described in this subsection so that it is able to implement adaptive management measures if necessary to avoid and minimize any drawdown effects.

Section 7.5.3.1 of this application discusses the potential drawdown of groundwater at the Mine Site and the potential effect this drawdown could have on wetlands at the Mine Site, which were matters discussed in the FEIS (Section 5.2.2.3.2 of Reference (1)). As a result of this possibility, PolyMet, during the project, will conduct ongoing monitoring for potential indirect wetland impacts in accordance with the wetland monitoring plan.

Similarly, Section 7.5.3.2 of this application discusses the anticipated temporary impact from the Plant Site appropriations. Wetland monitoring at the Plant Site will also be completed in accordance with the monitoring plan to evaluate potential changes as a result of the proposed appropriations and operation of the FTB Seepage Containment System.

8.1.2.2 Effects Due to Hydrologic Changes

Project water appropriations are not expected to cause adverse hydrologic or hydraulic effects (as discussed in Section 7.5.1 as well as in the preceding subsections of this Section 8.1.2). Therefore, effects to ecosystems due to hydrologic changes are not anticipated.

8.1.2.3 Effects Due to Discharge

Discharges from the WWTP are not expected to adversely affect ecosystems, because the discharges will not cause adverse hydrologic changes (Section 8.1.2.2 of this application), nor will they cause exceedances of applicable surface water quality standards that are protective of ecosystems (Section 6.7 of Reference (9)).

Construction dewatering from some Project installations may be discharged off-site under the terms of an MPCA construction stormwater permit and associated SWPPP (Table 6-1). Best management practices

(BMPs) will be used to avoid adverse effects to ecosystems from authorized off-site discharge during construction dewatering.

8.1.3 Effects on Water Resources

PolyMet assessed the net effects of the water appropriation, including the planned groundwater appropriations, on surface water and groundwater quality, and determined that the water appropriation is not projected to degrade water resources. Analysis conducted for the FEIS determined that:

- The water appropriation is not projected to cause exceedances of applicable surface water quality standards (Section 6.5 of Reference (4) and Section 6.7 of Reference (9)).
- The water appropriation is not projected to cause exceedances of applicable groundwater quality standards at the property boundary (Section 6.3 of Reference (4) and Section 6.5 of Reference (9)).

8.1.4 Effects on Public or Private Wells

Potential drawdown effects on private or public wells associated with the proposed appropriations at the Mine Site and the Plant Site were evaluated. The evaluation indicates that the Project's water appropriations will not interfere with private or public wells.

At the Mine Site, mine pit dewatering is expected to result in groundwater drawdown, but due to the relatively low hydraulic conductivity of the bedrock, the effect is expected to be localized. There may be measureable decreases in groundwater levels within a 1,000-foot distance from the mine pit rims (see Section 7.5.3.1). However, no public or private wells are known to exist in the vicinity of the Mine Site. This indicates that the appropriations will not reduce water levels beyond the reach of public water supply or private domestic wells, and no impacts to other groundwater users are expected.

Plant Site construction dewatering is expected to result in drawdown in the surficial aquifer that is minor, temporary, and localized (Section 7.5.3.2). Plant Site dewatering from the HRF wick drains, if needed, would be longer term, but would also be minor and localized (Section 7.5.3.2). Public records indicated that approximately 38 residential wells are located in the area between the Plant Site and the Embarrass River, some of which draw water from the surficial aquifer and some from bedrock. The closest well is more than one mile from the Plant Site boundary (Figure 4.2.2-18 of Reference (1)) The drawdown from dewatering at the Plant Site will not reduce water levels beyond the reach of these private domestic wells, no public water supply wells are present in the vicinity of the Plant Site, and no impacts to other groundwater users are expected.

8.2 Water Supply Management Rules (Minnesota Statutes, section 103G.265)

8.2.1 Regulatory Context

Minnesota Statutes, section 103G.265, governs water supply management and establishes various thresholds that apply to consumptive use of waters of the state. "Consumptive use" is defined as "water that is withdrawn from its source for immediate further use in the area of the source and is not directly returned to the source" (Minnesota Statutes, section 103G.005, subdivision 8). The volume thresholds in the consumptive use provisions of section 103G.265 are applied in this Section 8.2 to each permit or plan, consistent with the applicable statutory requirements.⁶

PolyMet has evaluated water appropriation on a permit-by-permit basis. For the purposes of consumptive use analysis in this Section 8.2, however, and based on MDNR's request, PolyMet also evaluated water appropriations based on two separate geographic areas, the Mine Site and the Plant Site. More specifically, PolyMet has evaluated consumptive use in the context of two general plans for appropriation of water, one relating to the Mine Site (which includes all four Individual Permits applicable to the Mine Site) and one at the Plant Site. These two plans reflect the geographic separation of the two Sites (which are located approximately 7 to 8 miles apart), along with the fact that the water appropriations from the two Sites are not from the same hydrogeologic units.

Minnesota Statutes, section 103G.265, subdivision 3 states that a water appropriation permit involving consumptive use of more than 2,000,000 gallons per day on average over a 30-day period may be approved where "the water remaining in the basin of origin will be adequate to meet the basin's water resources needs during the specified life of the consumptive use." The "basin of origin" refers to the "drainage basin of the Great Lakes" (Minnesota Statutes, section 103G.005, subdivision 6). Minnesota Statutes section 103G.265, subdivisions 2 and 4 contain provisions related to diversion of water, but because the Project will not divert water from the Great Lakes Basin, these statutory provisions related to diversions do not apply. Minnesota Statutes section 103G.265 subdivision 4 also governs consumptive use from the Great Lakes Basin of greater than 5,000,000 gallons on average per day (over a 30-day period), but this threshold will not be exceeded by the Project.

8.2.2 NorthMet Consumptive Use

8.2.2.1 Estimation Methods

PolyMet has calculated consumptive use estimates based on the estimates of pumping rates described in Section 5.3.1.

For this evaluation, all estimated groundwater pumping rates were summed on a monthly basis based on the Mine Site and Plant Site geographic areas. Estimated surface water pumping from Colby Lake was also evaluated. The analysis uses the appropriations schedules and assumptions described in Section 5.3.1.

⁶ See Minnesota Statutes, section 103G.265, which applies the thresholds to each "water use permit or plan that requires a permit..."

8.2.2.2 Consumptive Use Estimates

The estimated monthly consumptive use over time of groundwater from the Mine Site, groundwater from the Plant Site, and surface water from Colby Lake is shown on Figure 8-1. Water appropriation for the Colby Lake permit and for the total of all Mine Site Individual Permits is estimated to be above the 2,000,000 gallon-per-day average threshold as set forth in Minnesota Statutes, section 103G.265; prompting further consumptive use analysis (in Section 8.2.3). However, appropriations for each of these areas will be below the 5,000,000 gallon-per-day average threshold established in Minnesota Statutes section 103G.265 subdivision 4.

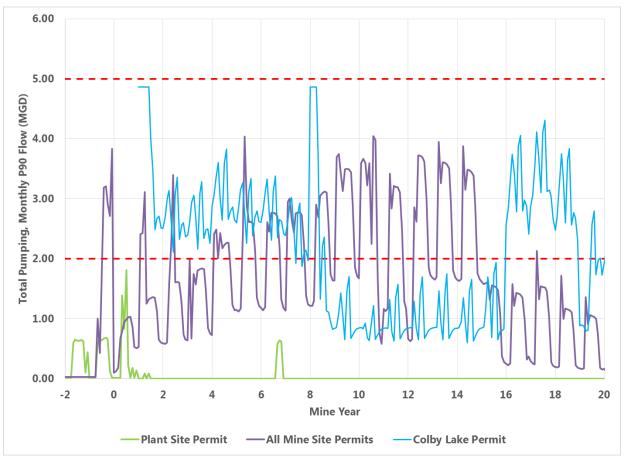


Figure 8-1 Monthly Total Pumping

The pattern of Mine Site consumptive use, shown on Figure 8-1, is primarily influenced by the following factors:

- Overburden stripping results in spikes in monthly appropriations during discrete stripping episodes that occur first during pre-operation construction, and continue through Mine Year 11.
- Construction dewatering for episodic expansion of the stockpile foundations and the Category 1
 Stockpile Groundwater Containment System also results in spikes in monthly appropriations.
- Operation of the Category 1 Stockpile Groundwater Containment System shows regular seasonal effects, with higher pumping rates in the summer than in the winter. Pumping rates are estimated

- to increase as the stockpile is expanded, then decrease when reclamation of the stockpile begins in Mine Year 14.
- The maximum 30-day average pumping rates are estimated to occur in Mine Years 9 and 10, coinciding with the final overburden stripping episodes for the West Pit.

The pattern of Plant Site consumptive use (Figure 8-1) shows primarily the effects of construction dewatering for the FTB Seepage Containment System over two construction seasons during the preoperation construction phase, and again in Mine Year 7 when the eastern segment of the system will be constructed.

The pattern of consumptive use from Colby Lake shows the largest withdrawals when PolyMet is filling the FTB Pond at the beginning of operations and again when FTB cells 1E and 2E merge and the pond expands. Appropriations decline from approximately Mine Year 9 through Mine Year 15, when the pit dewatering rate is highest, so less make-up water is needed. When pit flooding takes place, in Mine Year 16 through Mine Year 20, the Colby Lake appropriation rate increases, to provide make-up water to the Plant Site, as described in Section 3.0.

Based on Figure 8-1, estimated consumptive use can be summarized as follows:

- Estimated consumptive use does not exceed 5 million gallons per day average over a 30-day period at either the Mine Site, or the Plant Site regardless of whether the permit-by-permit or geographic approach is used. Therefore, proposed appropriations will not trigger the Great Lakes Basin consumptive-use requirements of Minnesota Statutes, section 103G.265, subdivision 4.
- Estimated consumptive use from all installations at the Plant Site does not exceed 2 million gallons per day average over a 30-day period regardless of whether the permit-by-permit or geographic approach is used.
- Estimated consumptive use of groundwater from the Mine Site and of surface water from Colby
 Lake will exceed 2 million gallons per day average over a 30-day period under either the permitby-permit or geographic approach. Therefore, to inform the Commissioner's review of this
 application, PolyMet has provided information on the adequacy of Lake Superior Basin water
 resources in accordance with Minnesota Statutes, section 103G.265.

8.2.3 Adequacy of Lake Superior Basin Water Resources

8.2.3.1 Description of Relevant Water Resources

The water resources of interest encompass the Great Lakes Basin as defined in Minnesota Statutes, section 103G.005. Within the Great Lakes Basin, the relevant water resources are those in the St. Louis River watershed, specifically in the Partridge River watershed and the Embarrass River watershed.

Surface water resources of the Partridge River watershed include the Partridge River and its tributaries, ten lakes larger than 10 acres, and numerous smaller water bodies (Reference (13)). Surface water resources of

the Embarrass River watershed include the Embarrass River and its tributaries, 42 lakes larger than 10 acres, and numerous smaller water bodies (Reference (13)).

As shown on Large Figure 1, portions of the Project are within the city of Hoyt Lakes and the city of Babbitt municipal boundaries. The city of Hoyt Lakes draws their municipal water supply from Colby Lake, within the Partridge River watershed, and the city of Babbitt draws their municipal water supply from a glacial aquifer within neither the Partridge River nor the Embarrass River watersheds.

The cities of Aurora, Biwabik, Belgrade, and McKinley are also located within these watersheds. Aurora is within the Partridge River watershed and draws their municipal water supply from the St. James Pit. The cities of Biwabik, Belgrade, and McKinley are in the Embarrass River watershed. Biwabik and McKinley currently draw their municipal water supply from former mine pits: the Canton Pit and the Corsica Pit, respectively. Belgrade draws their municipal water supply from the glacial aquifer within the Embarrass River watershed.

Groundwater resources of the Partridge River watershed and the Embarrass River watershed are described in Section 8.1.

8.2.3.2 Project Effect on Great Lakes Basin Water Supply

The cumulative effect on surface water resources in the St. Louis River watershed of the Project and other uses were evaluated in the FEIS. This evaluation included the Project actions with the potential to affect surface water flow (watershed area changes, groundwater withdrawals, operation of the FTB seepage capture systems, stream augmentation, and surface water withdrawal from Colby Lake). It also included the effects of the other mining, municipal, and power facilities that withdraw or discharge surface water in the Partridge River and Embarrass River watersheds. The FEIS concluded that the net effect of hydrologic changes from the Project and other uses would be an increase in flow of between 3.6 and 7.8 cfs at the confluence with the St. Louis River, or about 7 percent of average annual flow (Section 6.2.2.3 of Reference (1)).

The Project is not expected to adversely affect groundwater supply in the Partridge River watershed or Embarrass River watershed, as described in Sections 8.1.1 and 8.1.4 above.

Given the minimal impacts to surface waters in the Partridge River and Embarrass River watersheds, the net effect of the Project, including estimated consumptive use of groundwater and surface water, is not expected to impact surface water supply in the Great Lakes Basin, and the water remaining will be adequate to meet the basin's water resources needs during the appropriation period of PolyMet's operation.

8.3 Other State and Local Plans

Minnesota Statutes, section 103G.271, subdivision 2 requires that appropriations must be consistent with state, regional, and local water and related land resources management plans. Compliance with other applicable water management plans is described in the following sections.

8.3.1 Minnesota Statewide Drought Plan

In 1990, Minnesota Statutes, section 103G.293 mandated that MDNR establish a drought plan to minimize conflicts and negative impacts on Minnesota's natural resources and economy. MDNR developed the Minnesota Statewide Drought Plan which provides the framework for preparing for and responding to droughts. This plan uses a staged approach to implementing drought response actions, and it is available at: http://files.dnr.state.mn.us/natural resources/climate/drought/drought/plan matrix.pdf.

This application includes detailed information that can assist MDNR in its in watershed management decisions implementing the Minnesota Statewide Drought Plan when necessary. In particular, Sections 4.3, 4.4, and 6.2 through 6.5 of Reference (4) and Sections 4.2 through 4.5, 6.3, and 6.5 through 6.7 of Reference (9) provides information related to Project water that may be relevant to drought response considerations.

8.3.2 St. Louis County Land Ordinance 27 and St. Louis County Comprehensive Water Management Plan

St. Louis County Land Ordinance 27 contains policies, statements, goals, and plans for private and public land and water use in St. Louis County. Section 21 of this Ordinance provides a management plan for the St. Louis, Cloquet, and Whiteface Corridors in which portions of the Project are located. The Ordinance includes standards for several aspects of development, including the following management requirements applicable to Project water appropriations:

- water supply
- extractive use standards general standards for sand and gravel or mineral mining
- geology and mineral resource management general standards for the location of surface disturbances associated with this development

In addition, the St. Louis County Comprehensive Water Management Plan (CWMP) provides analysis of water and related land resources coupled with a recommended series of strategies designed to achieve the County's water management goals (Reference (14)).

PolyMet will meet the requirements of St. Louis County Ordinance 27 and CWMP, to the extent they are applicable and are not superseded by State law, by complying with the MDNR and MPCA requirements under the terms of the following permits to be issued for the Project:

- NPDES/SDS permits (MPCA) (regulating water quality)
- Permit to Mine (MDNR) (regulating mineral mining)
- Individual Permits for water appropriation (MDNR) (regulating water supply)

8.3.3 Local Water Resources Management Plans

Source Water Assessments for the cities of Babbitt, Aurora and Hoyt Lakes are publically available from the Minnesota Department of Health. The primary purpose of these documents is to assess the susceptibility of each community's drinking water supply to contamination; however, they also provide information related to the local management of drinking water resources. A summary of drinking water supply management information for each city is provided below:

- The city of Hoyt Lakes currently obtains drinking water from Colby Lake, which is within the Partridge River watershed. The Inner Emergency Response Area, as documented on the city of Hoyt Lakes' Source Water Assessment (Reference (15)), is more than three miles from the Plant Site and seven miles from the Mine Site. The text of the Source Water Assessment states that the Outer Source Water Management Area "generally follows the boundary of the sub-watersheds for Colby and Whitewater Lakes." The boundary of this sub-watershed, as shown in the FEIS⁷, is located approximately one mile south of the Plant Site and more than five miles from the Mine Site. As described in Section 7.5.3, potential drawdown effects at the Plant Site are expected to be localized and minor in nature and potential drawdown effects from the Mine Site are not expected beyond 3,200 feet from the pit edge. Therefore, the Outer Source Water Management Area for Colby Lake is outside the area of expected drawdown effects related to the proposed water appropriation. Other effects from the Project on water levels in Colby and Whitewater Lakes, including the combined impact of changes in Partridge River flow and Project appropriations from Colby Lake under Water Appropriation Permit 49-135, are described in Section 7.5.1. The combined effect of the Project will cause water level fluctuations in Colby Lake and Whitewater Reservoir that are within the conditions of the existing Permit No. 49-135 and are estimated to be less than past water level fluctuations during previous mining appropriations.
- The city of Babbitt currently obtains drinking water from wells completed in a glacial aquifer below the city. The source area for water entering these wells, encompassed within the Drinking Water Supply Management Area (Reference (16), is located outside the Partridge River and Embarrass River watersheds and is approximately five miles northeast of the Mine Site. As described in Section 8.1.4, the proposed water appropriations are not projected to interfere with public wells, including those located in the city of Babbitt.
- The city of Aurora currently obtains drinking water from the St. James Pit, which is located in the Partridge River watershed. The Source Water Assessment (Reference (17) defines both an Inner Emergency Response Area, designed to help the city address contaminant releases which present an imminent (acute) health concern to water users, and an Outer Source Water Management Area designed to enable protection of water users from long-term (chronic) health effects related to low levels of chemical contamination or the periodic presence of contaminants at low levels in the

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⁷ The boundaries of the sub-watershed for Colby and Whitewater Lakes as shown in the FEIS differ from the boundaries documented on the Source Water Assessment. The FEIS boundaries, which are more current than those in the November 2002 Source Water Assessment, are assumed to be more accurate.

surface water used by the city. The nearest boundary of the Outer Source Water Management Area is one mile from the Plant Site and more than seven miles from the Mine Site. As described in Section 7.5.3, potential drawdown effects at the Plant Site are expected to be localized and minor in nature, and potential drawdown effects from the Mine Site are not expected beyond 3,200 feet from the pit edge. Therefore, the Outer Source Water Management Area for the St. James Pit is outside the area of expected drawdown effects related to the proposed water appropriation.

9.0 Proposed Monitoring Plan

Monitoring in connection with water appropriations will measure flow rates and water levels to document appropriation rates and monitor potential effects of permitted dewatering. This section presents the proposed monitoring plan, including the proposed monitoring strategy, station locations and numbers, and frequency of water level monitoring and flow data collection. The contents of this proposed monitoring plan are subject to change prior to issuance of the water appropriations permits. Monitoring results will be reported to the State based on requirements in the relevant permits.

In addition to stations that will monitor the potential effects of permitted withdrawals, the water appropriation monitoring plan also includes stations that will monitor the stream augmentation program to evaluate potential hydrologic or ecological effects associated with decreased surface water flow in creeks downstream of the FTB seepage capture systems (Section 2.5 of Reference (2)).

The water appropriations monitoring plan includes four types of monitoring:

- Groundwater monitoring to identify the effects of permitted groundwater withdrawals on groundwater levels.
- Surface water monitoring to identify the effects of permitted groundwater withdrawals on surface water flow downstream of the Mine Site and the Plant Site,
- Appropriation source monitoring to document the volume of water withdrawn during operations by Project infrastructure (such as the mine pits, the Category 1 Stockpile Groundwater Containment System, and the Colby Lake Pumphouse).
- Stream augmentation monitoring to document the collected seepage flows, the augmentation flows, the streamflow, and ecologic conditions in Unnamed (Mud Lake) Creek, Trimble Creek, Unnamed Creek, and Second Creek.

The water appropriation monitoring plan is summarized in a series of figures and tables, as follows:

- Large Figure 7 through Large Figure 10 show the proposed monitoring stations for groundwater, surface water, appropriation sources, and stream augmentation.
- Large Table 2 through Large Table 5 describe the purpose, type, and frequency of monitoring, the proposed parameter groups to be monitored, and the proposed frequency and method of reporting.

Information included on the figures and tables is described further in the following sections.

9.1 Groundwater Monitoring

Groundwater monitoring will measure the effects of permitted groundwater withdrawals on groundwater levels. Therefore, groundwater monitoring focuses on water levels in the bedrock at the Mine Site, as shown on Large Figure 7. Large Table 2 lists the Mine Site groundwater monitoring stations and describes their location and purpose.

Effects of Plant Site groundwater withdrawals are expected to be localized; therefore, no groundwater monitoring at the Plant Site is proposed.

9.2 Surface Water Monitoring

Surface water monitoring will monitor the flow in the Partridge River to assess changes associated with mine pit dewatering and in the Embarrass River to assess changes associated with seepage collection and stream augmentation. Large Table 3 lists the surface water monitoring stations and describes their purpose and location. The proposed surface water monitoring stations are shown on Large Figure 8. Continuous flow monitoring will occur at each of these locations via stream gages.

9.3 Appropriation Source Monitoring

Appropriation source monitoring will measure flows from infrastructure that will withdraw groundwater and surface water during operations. The water level in Colby Lake is currently monitored by Minnesota Power under water appropriation permit #1949-0135. PolyMet does not anticipate that duplicative monitoring of the lake level is necessary for its Colby Lake appropriation permit. Should Minnesota Power discontinue Colby Lake water level monitoring, PolyMet is prepared to add Colby Lake water level monitoring to its appropriation source monitoring program. Large Table 4 lists the appropriation sources and describes their purpose and location. The proposed appropriation source monitoring stations are shown on Large Figure 9. Continuous flow monitoring will occur at each of these locations via flow meters. If underdrain systems are constructed at any of the temporary stockpiles, PolyMet will establish appropriation source monitoring stations to measure those flows. Likewise, if wick drains are used at the HRF, PolyMet will establish an appropriation source monitoring station to measure those flows.

9.4 Temporary Construction Dewatering Monitoring

The volume of water pumped from each temporary construction dewatering installation will be measured within 10% accuracy using industry standard methods appropriate to the specific installation. Temporary construction dewatering monitoring methods and locations will be described in annual reports for the year that the temporary dewatering occurs.

9.5 Stream Augmentation Monitoring

Stream augmentation monitoring is part of the overall appropriations monitoring program to measure flow rates and water levels to evaluate potential effects of permitted dewatering. During the environmental review process, PolyMet committed to augment flow in Unnamed (Mud Lake) Creek, Trimble Creek, Unnamed Creek, and Second Creek to maintain average annual flow within ±20% of existing conditions for purposes of maintaining hydrology and existing aquatic ecology (Section 5.2.2.3.3 of Reference (1)).

9.5.1 Monitoring Approach

Four types of monitoring are proposed:

- Flow monitoring will record the amount of water collected by the FTB seepage capture systems
 from the headwater area of each creek. Flow will be measured at appropriate locations in the
 return piping system. Continuous flow monitoring will occur at each of these stations via flow
 meters.
- Augmentation flow monitoring will record the amount of water the Project delivers to the headwater area of each creek. Augmentation flows to Trimble Creek, Unnamed Creek, and Second Creek will be measured at the surface water discharge monitoring stations via flow meters.
 Augmentation flow to Unnamed (Mud Lake) Creek will be measured at the outlet of the drainage swale.
- Aquatic biota monitoring will document the characteristics of the biotic community in a channelized portion of each creek. It will be conducted each spring after snowmelt, following MPCA-recommended protocol.
- In-stream flow monitoring will be conducted in a channelized portion of each creek, if suitable
 locations can be found. The creeks are extremely low gradient streams, intermittently channelized,
 with extensive beaver activity. Field reconnaissance will be conducted in consultation with the
 MDNR to determine where suitable locations can be found for which accurate flow rating curves
 could be developed. Continuous flow monitoring will occur at each of these stations via stream
 gages.

The proposed stream augmentation monitoring stations are shown on Large Figure 10. Proposed locations may be refined during permitting, and final locations will be determined based on final engineering, stream channel characteristics, accessibility, and consultations with the MDNR.

9.5.2 Implementation Goals and Considerations

PolyMet will discharge treated effluent to the headwater areas of Trimble Creek, Unnamed Creek, and Second Creek, as well as divert flow through a drainage swale to the headwater area of Unnamed (Mud Lake) Creek, to replace flow captured by the FTB seepage capture systems (see Sections 3.3. and 3.4). The goal will be to maintain average annual flow in these streams within $\pm 20\%$ of natural conditions.

The existing characteristics of Unnamed (Mud Lake) Creek, Trimble Creek, Unnamed Creek, and Second Creek present unique challenges for evaluating the effectiveness of stream augmentation flows relative to this goal. These streams flow at very low velocity through wetlands with only intermittent channels, which results in low precision for stream gages. In addition, water levels are largely influenced by beaver activity, vegetative conditions, and seepage from the existing Tailings Basin. Because of this, stream flow data alone cannot be used to assess performance relative to the goal of maintaining average annual flows within ±20% of existing conditions. During the initial period of operations, discharge rates to each subwatershed will be based on the modeling work conducted for the FEIS using the GoldSim model and will be proportionate to the volume that is collected by the FTB seepage capture systems. The monitoring approach outlined above will provide the data necessary to allow PolyMet to make adjustments to

augmentation flow rates, as needed, to achieve the objectives of minimizing ecologic impacts, if any, in the receiving waters.

10.0 References

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- 4. —. NorthMet Project Water Modeling Data Package Volume 1 Mine Site (v14). February 2015.
- 5. **Barr Engineering Co.** Hydrogeologic Investigation Phase I, PolyMet NorthMet Mine Site, RS-02 Draft-02. November 2006.
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- 12. **Barr Engineering Co.** Hydrogeology of Fractured Bedrock in the Vicinity of the NorthMet Project (v3). December 2014.
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- 15. City of Hoyt Lakes, Minnesota. Source Water Assessment. November 2002.

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- 17. City of Aurora, Minnesota. Source Water Assessment. n.d.
- 18. **Marinelli, Fred and Niccoli, Walter L.** Simple Analytical Equations for Estimating Ground Water Inflow to a Mine Pit. *Ground Water.* March-April 2000. Vol. 38, No. 2, pp. 311-314.
- 19. **Golder Associates.** Underdrain Piping Calculations Technical Memorandum. January 5, 2013.

Large Tables

Large Table 1 Pumping Estimation Methods and Assumptions

Flow Source	Installations	Estimate Methods and Key Assumptions	Uncertainty Factor	Rationale for uncertainty factor
Pit groundwater	East Pit Central Pit West Pit	MODFLOW results with an uncertainty factor applied in GoldSim (GoldSim P90 = 1.3x MODFLOW)	1.0	GoldSim includes uncertainty, P90 used
Net precipitation onto pits	East Pit Central Pit West Pit	GoldSim results including precipitation variability (P90 snowmelt is approximately 8.1-inches (in) over one month)	1.0	GoldSim includes uncertainty, P90 used
Category 1 Stockpile Groundwater Containment System flow	Category 1 Stockpile Groundwater Containment System	GoldSim results including precipitation variability (P90 monthly precipitation is approximately 4.9-in)	1.0	GoldSim includes uncertainty, P90 used
Mine Site construction area dewatering	East Pit Central Pit West Pit Category 1 Waste Rock Stockpile construction Category 2/3 Waste Rock Stockpile construction Category 4 Waste Rock Stockpile construction Ore Surge Pile construction Category 1 Stockpile Groundwater Containment System construction Mine water pond construction Stormwater pond construction Construction of new buildings	Depth of excavation from 8-ft to 20-ft Depth to water table from 0-ft to 5-ft Porosity of mineral soils 47% Porosity of peat 89% Assumed 50% of pore water dewatered, remainder excavated with soil	1.5	50% increase to reflect uncertainty in pore water dewatering
Mine Site excavation groundwater inflows	East Pit Central Pit West Pit Category 1 Waste Rock Stockpile construction Category 2/3 Waste Rock Stockpile construction Category 4 Waste Rock Stockpile construction Ore Surge Pile construction Category 1 Stockpile Groundwater Containment System construction Mine water pond construction Stormwater pond construction	Inflow to excavations from surficial aquifer and bedrock is estimated based on Reference (18) Estimated surficial aquifer hydraulic conductivity (the primary sensitive parameter) is 2.9 ft/day	6.0	The maximum surficial aquifer hydraulic conductivity used in GoldSim modeling near the pits is approximately 18 ft/day, resulting in an estimated high-end inflow approximately 6 times higher
Mine Site excavation runoff	East Pit Central Pit West Pit Category 1 Waste Rock Stockpile construction Category 2/3 Waste Rock Stockpile construction Category 4 Waste Rock Stockpile construction Ore Surge Pile construction	Monthly runoff from open areas assumed to be approximately 3.2-in	1.5	Results in runoff similar to the GoldSim peak P90 used for the precipitation on the Category 1 Waste Rock Stockpile

Flow Source	Installations	Estimate Methods and Key Assumptions	Uncertainty Factor	Rationale for uncertainty factor
Stockpile foundation underdrains	Category 2/3 Waste Rock Stockpile underdrains, if needed Category 4 Waste Rock Stockpile underdrains, if needed Ore Surge Pile underdrains, if needed	Inflow from soil compression based on consolidation theory and laboratory consolidation tests, with depth to bedrock from 14-ft to 26-ft and stockpile height from 40-ft to 145-ft (Reference (19))	6.0	Consistent with excavation groundwater uncertainty
Plant Site standing water in wetlands	Flotation Tailings Basin (FTB) Seepage Containment System construction Hydrometallurgical Residue Facility (HRF) construction	Wetlands assumed to represent 50% to 75% of construction footprint Wetlands assumed to contain 2-ft of standing water	2.0	100% increase to reflect uncertainty in depth of water to drain
Plant Site excavation runoff	FTB Seepage Containment System construction HRF construction seepage collection	Total direct precipitation and runoff assumed to equal 5 times the average monthly direct precipitation from GoldSim inputs	1.0	Conservatism included in runoff assumption
Plant Site excavation groundwater inflows (1)	FTB Seepage Containment System construction	Assumed 5 gpm per linear foot of excavation for initial dewatering	3.0 (initial)	100% increase from Mine Site construction area dewatering uncertainty due to uncertain soils
groundwater innows (1)		Assumed 0.087 gpm per linear foot of excavation for steady groundwater inflows	6.0 (steady)	Consistent with Mine Site excavation groundwater uncertainty
Plant Site excavation groundwater inflows (2)	HRF construction	Assumed 0.05 gpm per linear foot of excavation due to shallow nature of system	6.0	Consistent with Mine Site excavation groundwater uncertainty
Plant Site construction area dewatering (1)	Colby Lake pipeline upgrades	Assumed 200 gpm continuous dewatering during construction in Muskeg soils	1.5	Consistent with Mine Site Mine Site construction area dewatering uncertainty
Plant Site construction area dewatering (2)	Sewage Treatment System construction	Assumed 50 gpm continuous dewatering during construction of sewage sump	1.5	Consistent with Mine Site Mine Site construction area dewatering uncertainty
HRF wick drains	HRF wick drain operation, if needed	Assumed porosity of 50% Volume of water removed during liner pre-loading estimated based on subgrade deflection estimates Volume during operations estimated based on stockpile foundation underdrain rates	2.0	100% increase to reflect uncertainty in pore water dewatering

Large Table 2 Water Appropriation Monitoring: Groundwater

Existing Station ID	Proposed Appropriation Station ID	Bedrock or Surficial Aquifer	Description	Monitoring Type	Parameter Group(s)	Frequency	Reporting	Overlapping Monitoring
MW-2	GW402	Surficial Aquifer	Monitors groundwater downgradient from the West Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
MW-12	GW412	Surficial Aquifer	Monitors groundwater north of the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
MW-14	GW414	Surficial Aquifer	Monitors groundwater northwest of the Category 1 Stockpile Groundwater Containment System. App		Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
MW-15	GW415	Surficial Aquifer	Monitors groundwater west of the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
MW-16	GW416	Surficial Aquifer	Monitors groundwater downgradient from the West Pit and the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
GW-M001	GW419	Surficial Aquifer	Monitors groundwater downgradient of the Category 4 Waste Rock Stockpile.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW430	Surficial Aquifer	Monitors groundwater downgradient from the East Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	
	GW468	Surficial Aquifer	Monitors groundwater between the West Pit and the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW470	Surficial Aquifer	Monitors groundwater north of the West Pit, north of the Mine Site boundary.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW499	Surficial Aquifer	Monitors groundwater north of the West Pit	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW502	Bedrock	Monitors groundwater downgradient from the West Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
OB-5	GW505	Bedrock	Monitors groundwater adjacent to the East Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
OB-1	GW507	Bedrock	Monitors groundwater between the West Pit and the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW508	Bedrock	Monitors groundwater between the West Pit and the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW509	Bedrock	Monitors groundwater north of the West Pit	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW510	Bedrock	Monitors groundwater north of the West Pit, north of the Mine Site boundary.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW512	Bedrock	Monitors groundwater north of the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW514	Bedrock	Monitors groundwater northwest of the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW515	Bedrock	Monitors groundwater west of the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW516	Bedrock	Monitors groundwater downgradient from the West Pit and the Category 1 Stockpile Groundwater Containment System.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	NPDES/SDS
	GW530	Bedrock	Monitors groundwater downgradient from the East Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	
	GW531	Bedrock	Monitors groundwater adjacent to the Category 2/3 Stockpile	Appropriation	Water Levels	Monthly; Year-round	Annual Report	
	GW532	Bedrock	Monitors groundwater adjacent to the West Pit.	Appropriation	Water Levels	Monthly; Year-round	Annual Report	

Large Table 3 Water Appropriation Monitoring: Surface Water

Water Body	Existing Station ID	Proposed Appropriation Station ID	Description	Monitoring Type	Parameter Group(s)	Frequency	Reporting	Overlapping Monitoring
Partridge River	PM-2 / SW002	SW402	Monitors Partridge River upstream of the Mine Site.	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Partridge River	SW004c	SW413	Monitors Partridge River upstream of the confluence with the South Branch of the Partridge River, and downstream of the confluence with Unnamed Creek which is the future West Pit overflow.	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Partridge River	SW006	SW414	Monitors Partridge River upstream of Colby Lake. This is the location of the historical United States Geological Survey (USGS) gage.	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	
Embarrass River	PM-12.2	SW008	Monitors Embarrass River upstream of the Plant Site.	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Embarrass River	PM-13 / SW005	SW005	Monitors Embarrass River downstream of the Plant Site.	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS

Large Table 4 Water Appropriation Monitoring: Appropriation Sources

Internal Appropriation Source	Existing Station ID	Proposed Appropriation Station ID	Description	Monitoring Type	Parameter Group(s)	Frequency	Reporting	Overlapping Monitoring
East Pit		WS401	Flow from East Pit dewatering	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
West Pit		WS402	Flow from West Pit dewatering	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
West Pit		WS403	Flow from West Pit dewatering	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Central Pit		WS404	Flow from Central Pit dewatering	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Category 1 Stockpile Groundwater Containment System		WS411	Flow from the Category 1 Stockpile Groundwater Containment System sump	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Category 1 Stockpile Groundwater Containment System		WS412	Flow from the Category 1 Stockpile Groundwater Containment System sump	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Central Pumping Station (CPS) Pond		WS414	Flow from CPS Pond: this is the combined flow from the Waste Water Treatment Facility (WWTF) treated effluent, construction mine water basin, and Overburden Storage and Laydown Area drainage that goes to the Plant Site via the Treated Water Pipeline	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Colby Lake		SW047	Monitors the flow from Colby Lake	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	
Colby Lake	By Minnesota Power	By Minnesota Power	Colby Lake water level (data collected by Minnesota Power and reported in PolyMet's annual report)	Appropriation	By Minnesota Power	By Minnesota Power	Annual Report	
Category 2/3 Stockpile Underdrain		GW491	Flow from the Category 2/3 Stockpile underdrain system (if underdrain is installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Category 2/3 Stockpile Underdrain	1	GW492	Flow from the Category 2/3 Stockpile underdrain system (if underdrain is installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Category 2/3 Stockpile Underdrain	-1	GW493	Flow from the Category 2/3 Stockpile underdrain system (if underdrain is installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Category 4 Stockpile Underdrain		GW494	Flow from the Category 4 Stockpile underdrain system (if underdrain is installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Ore Surge Piile Underdrain	-1	GW495	Flow from the Ore Surge Pile underdrain system (if underdrain is installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	NPDES/SDS
Hydrometallurgical Residue Facility (HRF) Wick Drain	_	GW496	Flow from the HRF wick drain system (if installed)	Appropriation	Continuous Flow Monitoring	Continuous flow monitoring; Year-round	Annual Report	

Note: Temporary construction dewatering installations will be measured within 10% accuracy using industry standard methods appropriate to the specific installation.

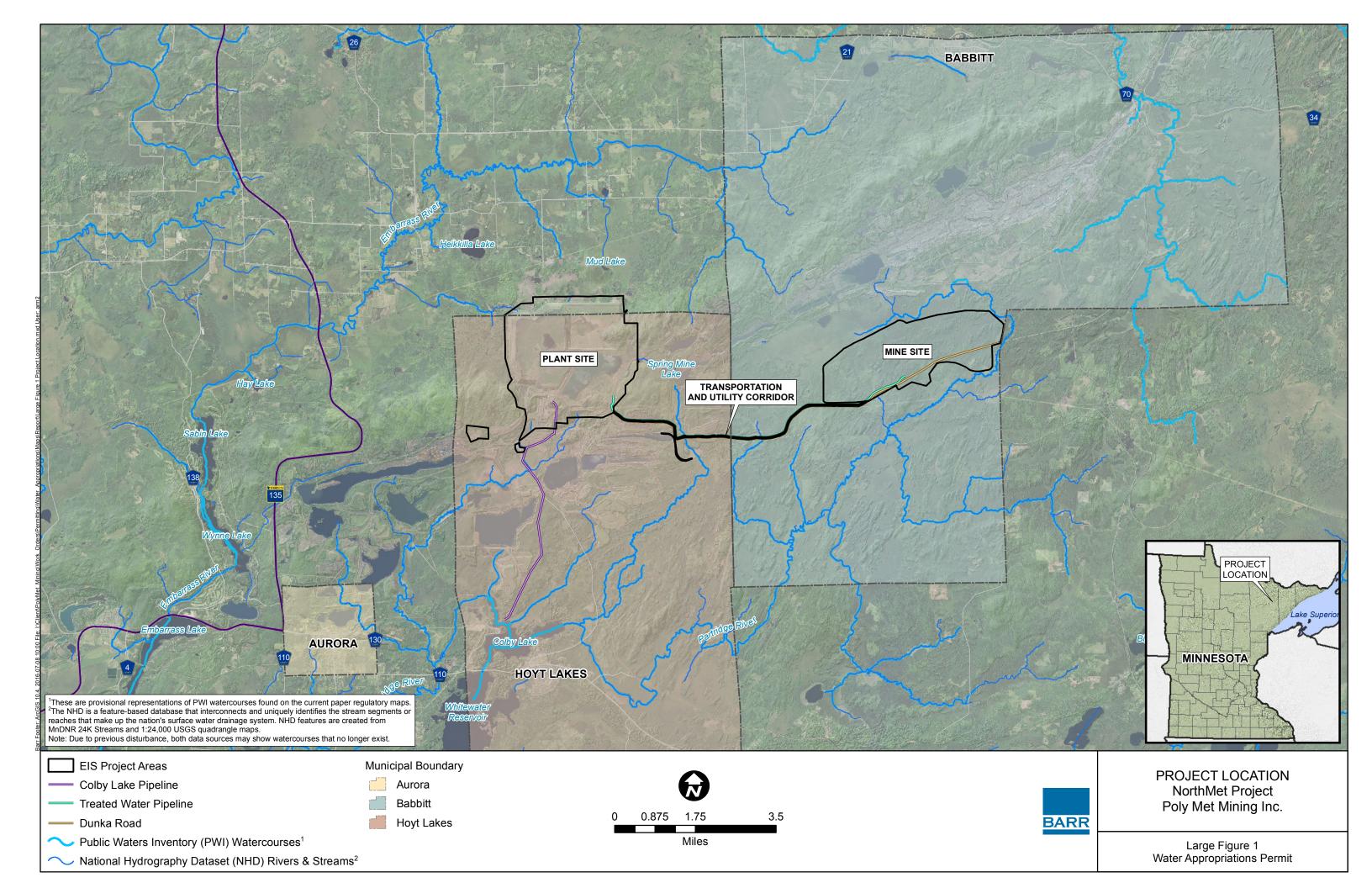
Large Table 5 Water Appropriation Monitoring: Stream Augmentation Monitoring

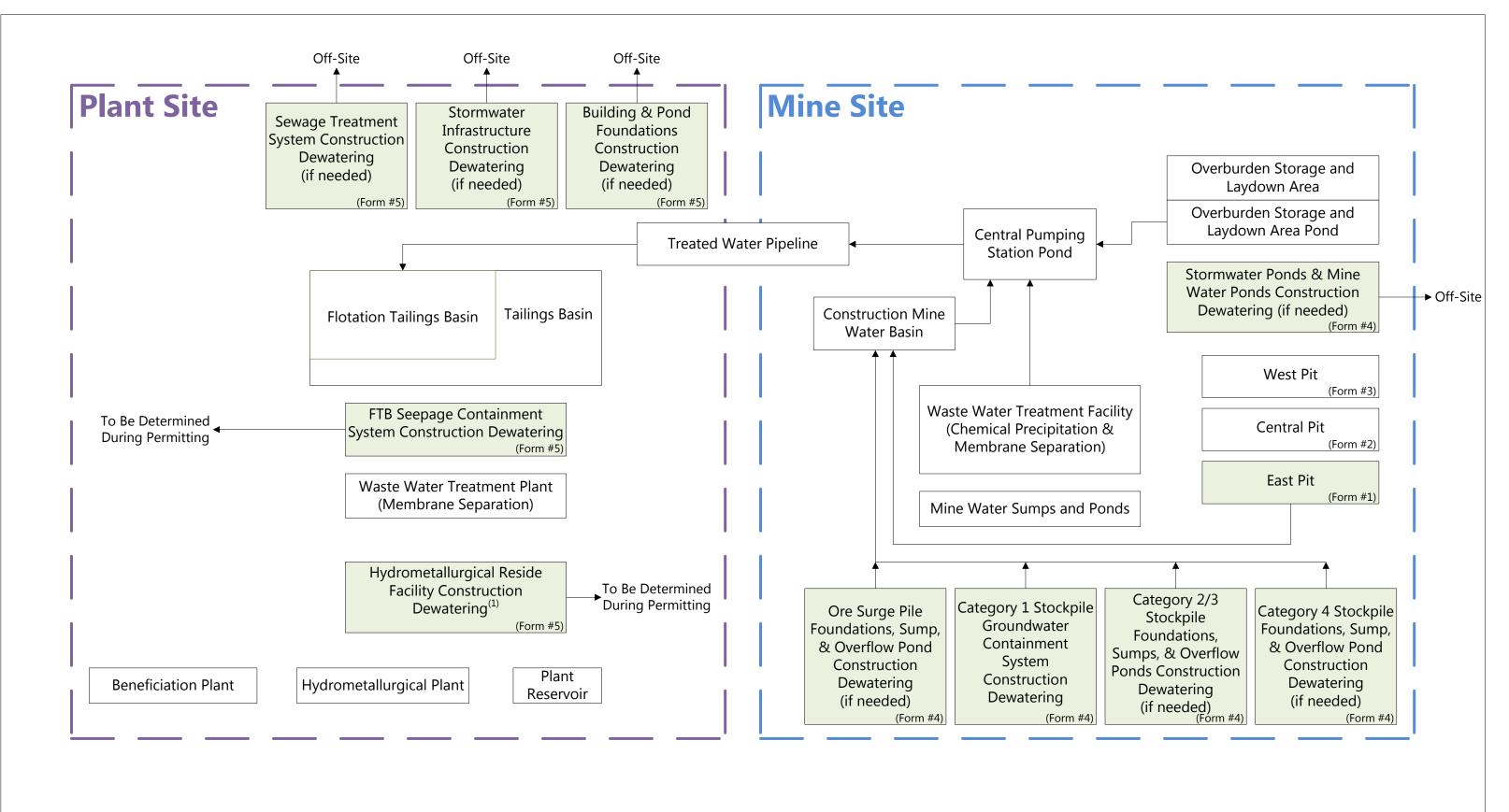
Water Body	Existing Station ID	Proposed Appropriation Station ID	Description	Monitoring Type	Parameter Group(s)	Frequency of Monitoring	Frequency of Reporting	Overlapping Monitoring
Seepage Fl	ow Monito	pring						
Unnamed Creek	(New Station)	WS008	Monitor amount of seepage extracted from Unnamed Creek watershed	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	
Trimble Creek	(New Station)	WS007	Monitor amount of seepage extracted from Trimble Creek watershed	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	
Second Creek	(New Station)	WS003	Monitor amount of seepage extracted from Second Creek watershed	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS
Unnamed (Mud Lake) Creek	(New Station)	WS006	Monitor amount of seepage extracted from Unnamed (Mud Lake) Creek watershed	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	
Augmentat	tion Flow N	Monitoring						
Unnamed Creek	(New Station)	SD002	Monitor Waste Water Treatment Plant (WWTP) discharge flow to headwater wetlands of Unnamed Creek for stream augmentation. Monitoring point is at the WWTP.	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS
Trimble Creek	(New Station)	SD003	Monitor WWTP discharge flow to headwater wetlands of Trimble Creek for stream augmentation. Monitoring point is at the WWTP.	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS
Second Creek	(New Station)	SD004	Monitor WWTP discharge flow to Second Creek for stream augmentation. Monitoring point is at the WWTP.	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS
Unnamed (Mud Lake) Creek	(New Station)	SA001	Monitor flow from Drainage Swale to headwaters area of Unnamed (Mud Lake) Creek	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	
Biotic Surv	еу							
Unnamed Creek	PM-11 / SW003	SW003	Monitor Unnamed Creek in a channelized location, downstream of surface water discharge outfall	Stream Augmentation	Aquatic Biotic Survey	Annually	Annual Report	NPDES/SDS
Trimble Creek	TC-1a	SA003	Monitor Trimble Creek in a channelized location, downstream of surface water discharge outfall	Stream Augmentation	Aquatic Biotic Survey	Annually	Annual Report	NPDES/SDS
Second Creek	PM-7 / SD026	SW020	Monitor Second Creek in a channelized location, downstream of surface water discharge outfall	Stream Augmentation	Aquatic Biotic Survey	Annually	Annual Report	NPDES/SDS
Unnamed (Mud Lake) Creek	MLC-1	SA002	Monitor Unnamed (Mud Lake) Creek in a channelized location, downstream of the drainage swale	Stream Augmentation	Aquatic Biotic Survey	Annually	Annual Report	NPDES/SDS

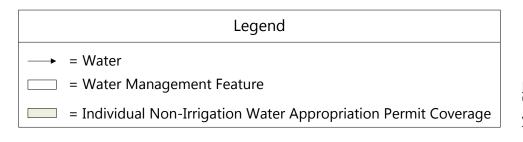
Water Body	Existing Station ID	Proposed Appropriation Station ID	Description	Monitoring Type	Parameter Group(s)	Frequency of Monitoring	Frequency of Reporting	Overlapping Monitoring			
In-Stream	In-Stream Flow Monitoring										
Unnamed Creek		SW003	Monitor Unnamed Creek in a channelized location (1)	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS			
Trimble Creek		SA003	Monitor Trimble Creek in a channelized location ⁽¹⁾	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS			
Second Creek		SW020	Monitor Second Creek in a channelized location ⁽¹⁾	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS			
Unnamed (Mud Lake) Creek		SA002	Monitor Unnamed (Mud Lake) Creek in a channelized location ⁽¹⁾	Stream Augmentation	Continuous Flow Monitoring	Year-round	Annual Report	NPDES/SDS			

⁽¹⁾ In-stream flow monitoring is contingent on identifying suitable locations for which accurate flow rating curves could be developed. The creeks are extremely low gradient streams, intermittently channelized, with extensive beaver activity. Field reconnaissance, in consultation with the Minnesota Department of Natural Resources, will be conducted to determine if suitable locations can be found.

Large Figures



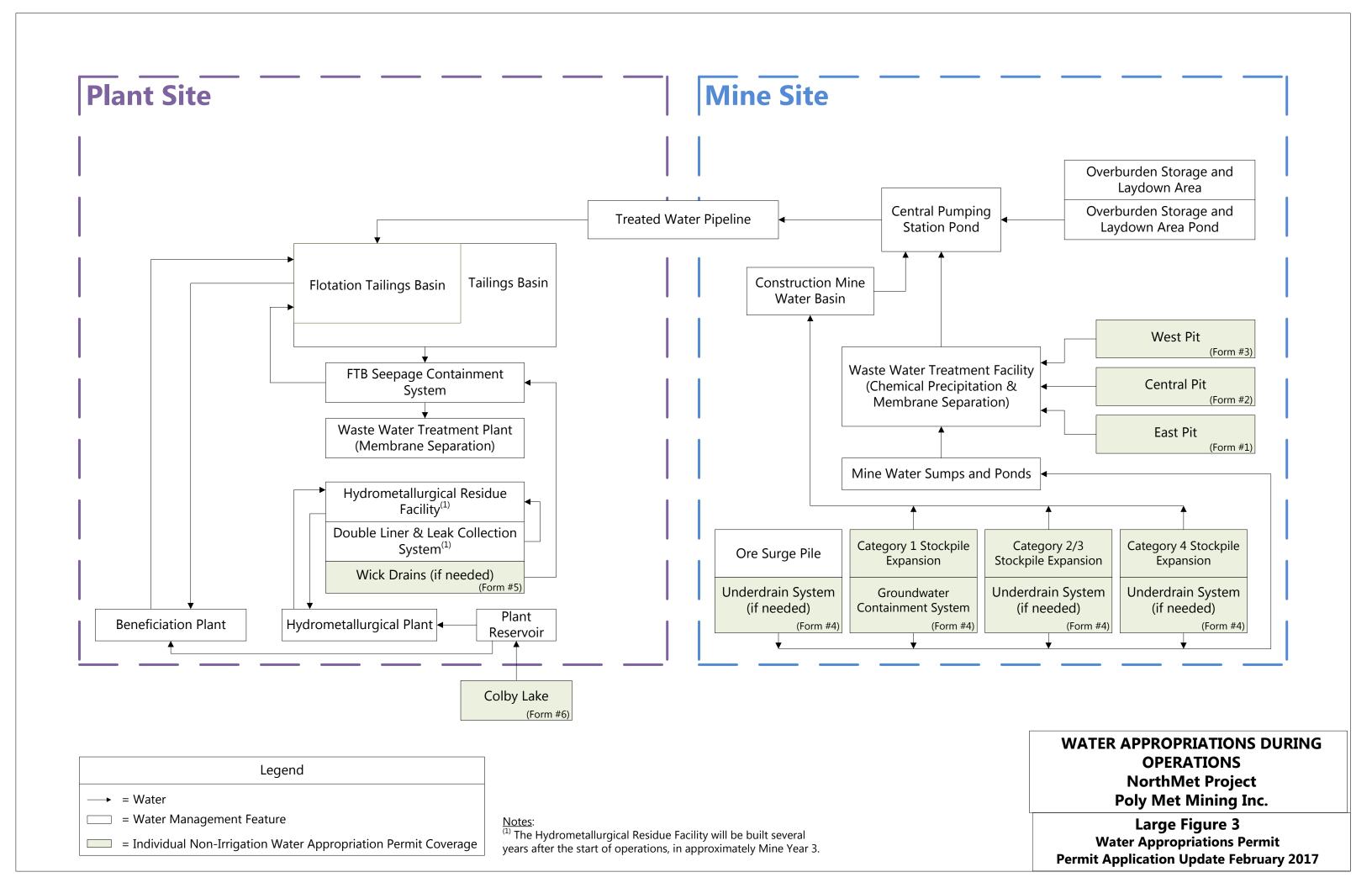


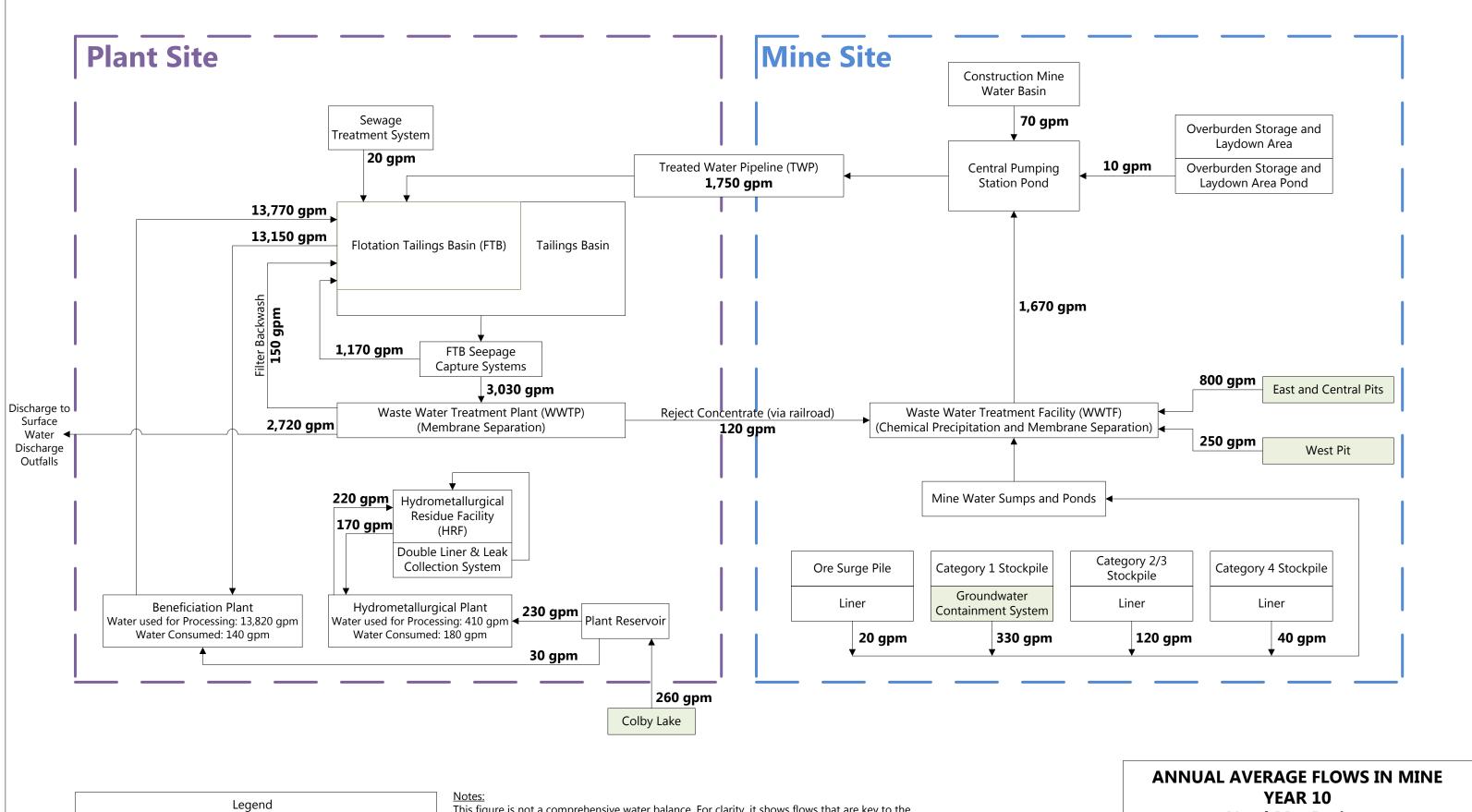


(1) The Hydrometallurgical Residue Facility will be built several years after the start of operations, in approximately Mine Year 3.

WATER APPROPRIATIONS DURING PRE-OPERATION CONSTRUCTION NorthMet Project Poly Met Mining Inc.

Large Figure 2
Water Appropriations Permit



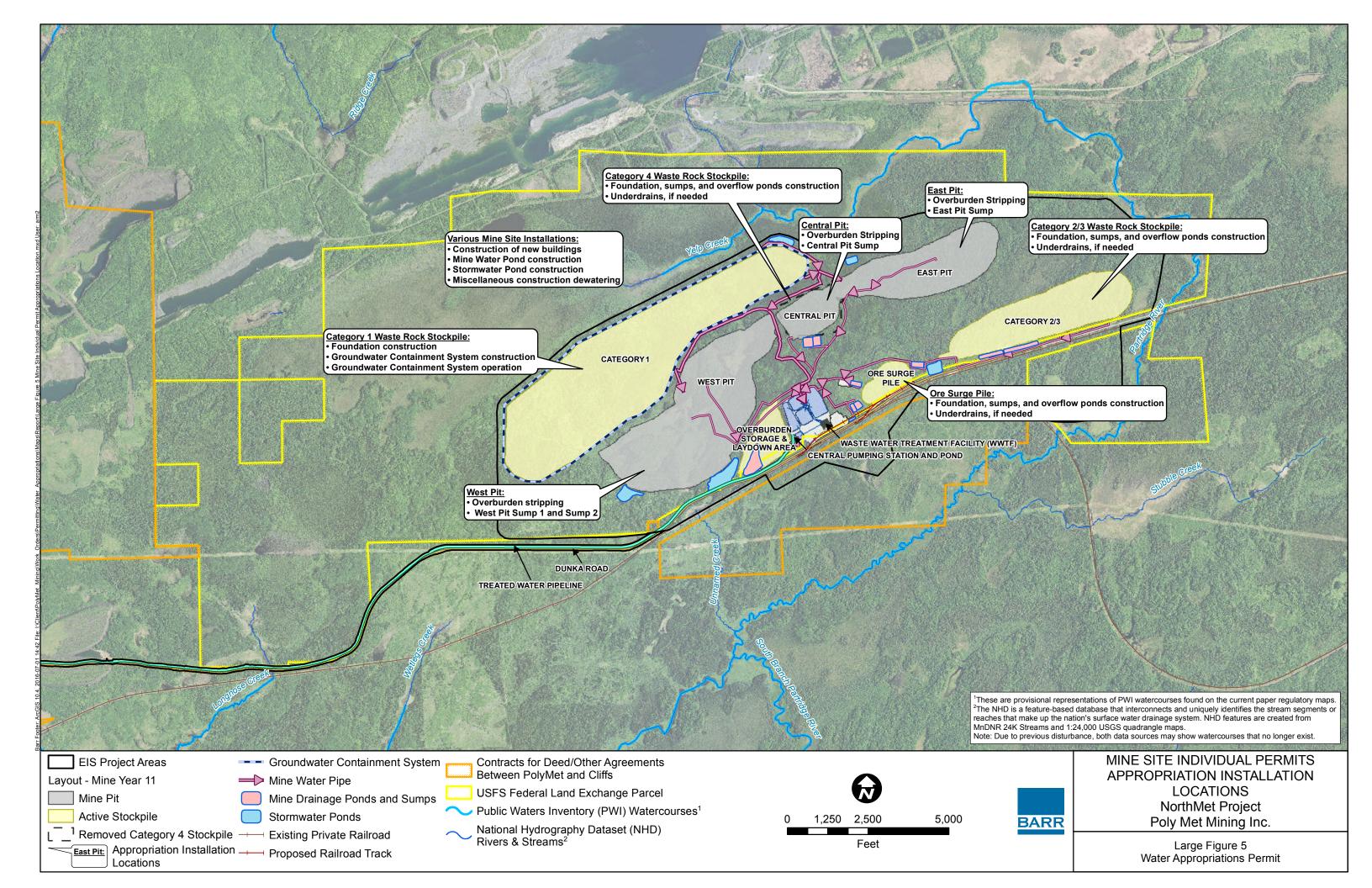


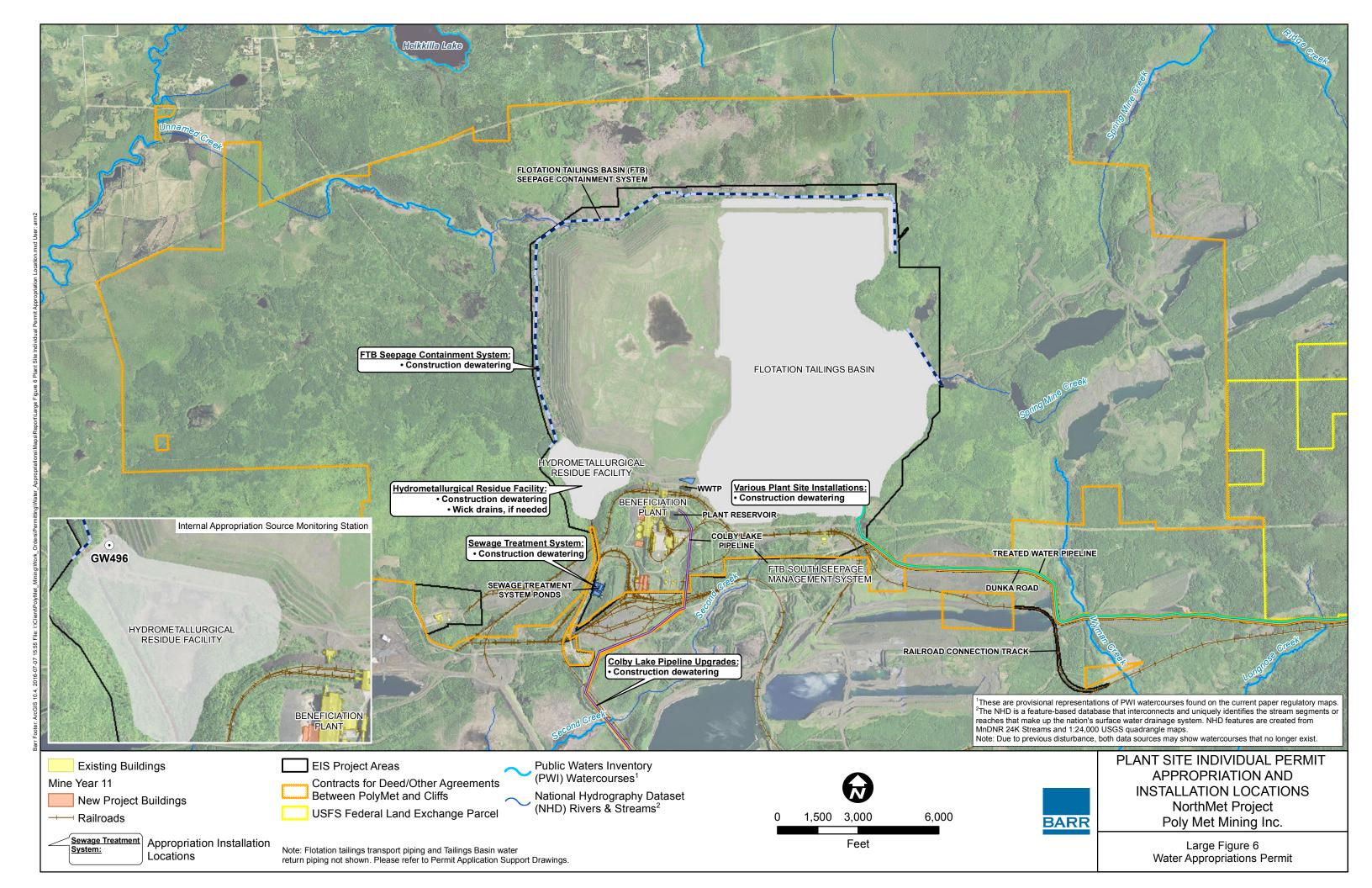
= Approximate Water Flow in Gallons Per Minute (gpm) = Water Appropriation Source

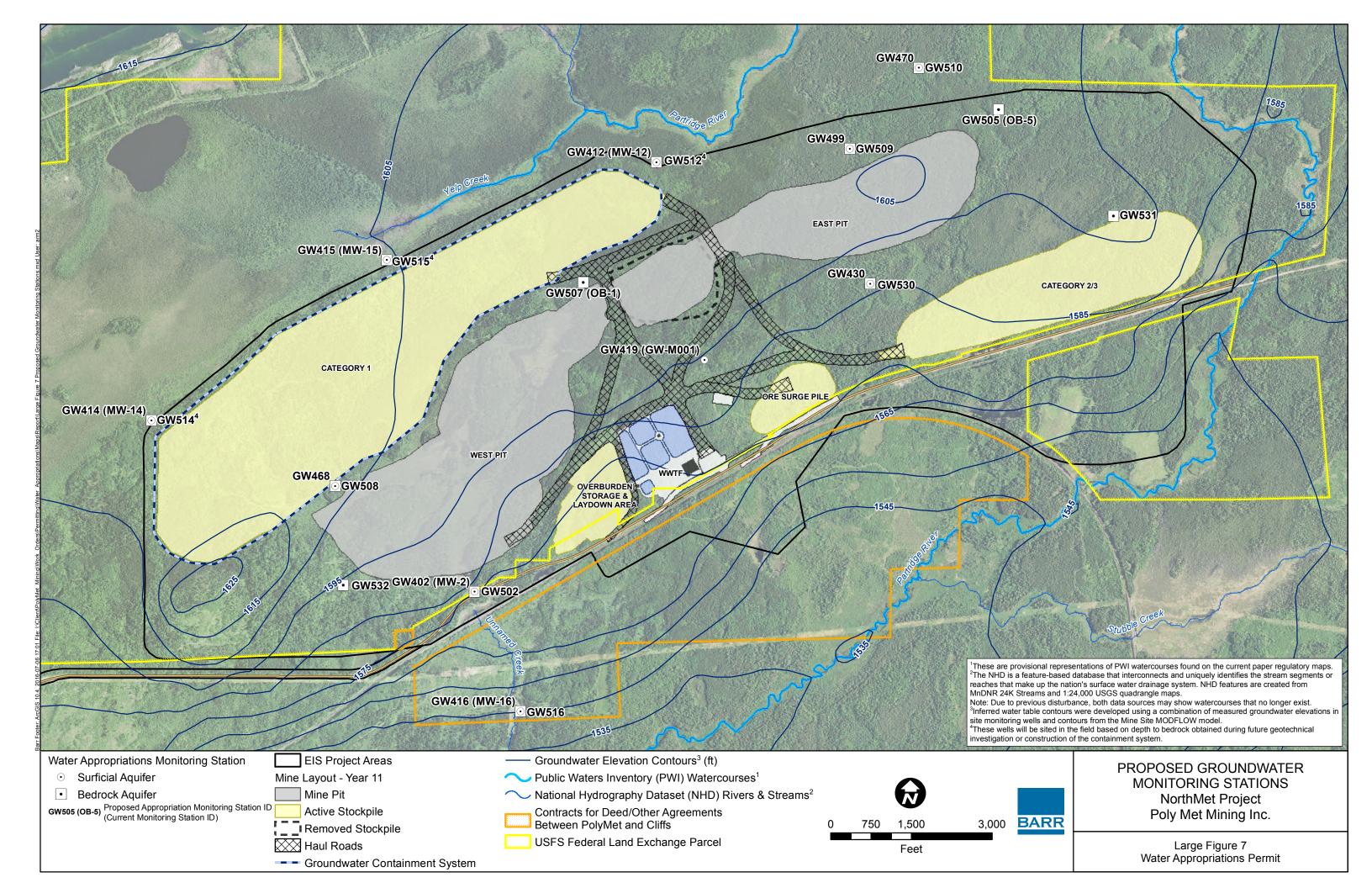
This figure is not a comprehensive water balance. For clarity, it shows flows that are key to the NorthMet Project's overall water use strategy, and omits flows such as inflows due to net precipitation and outflows due to potential liner leakage and other potential losses. Because not all flows are shown, and because flow rates are rounded, total flows may not equal the sum of their contributing parts. Water flows were obtained from the Water Modeling Data Package - Mine Site, Version 14 (Reference (4)) and the Water Modeling Data Package – Plant Site, Version 11 (Reference (9)).

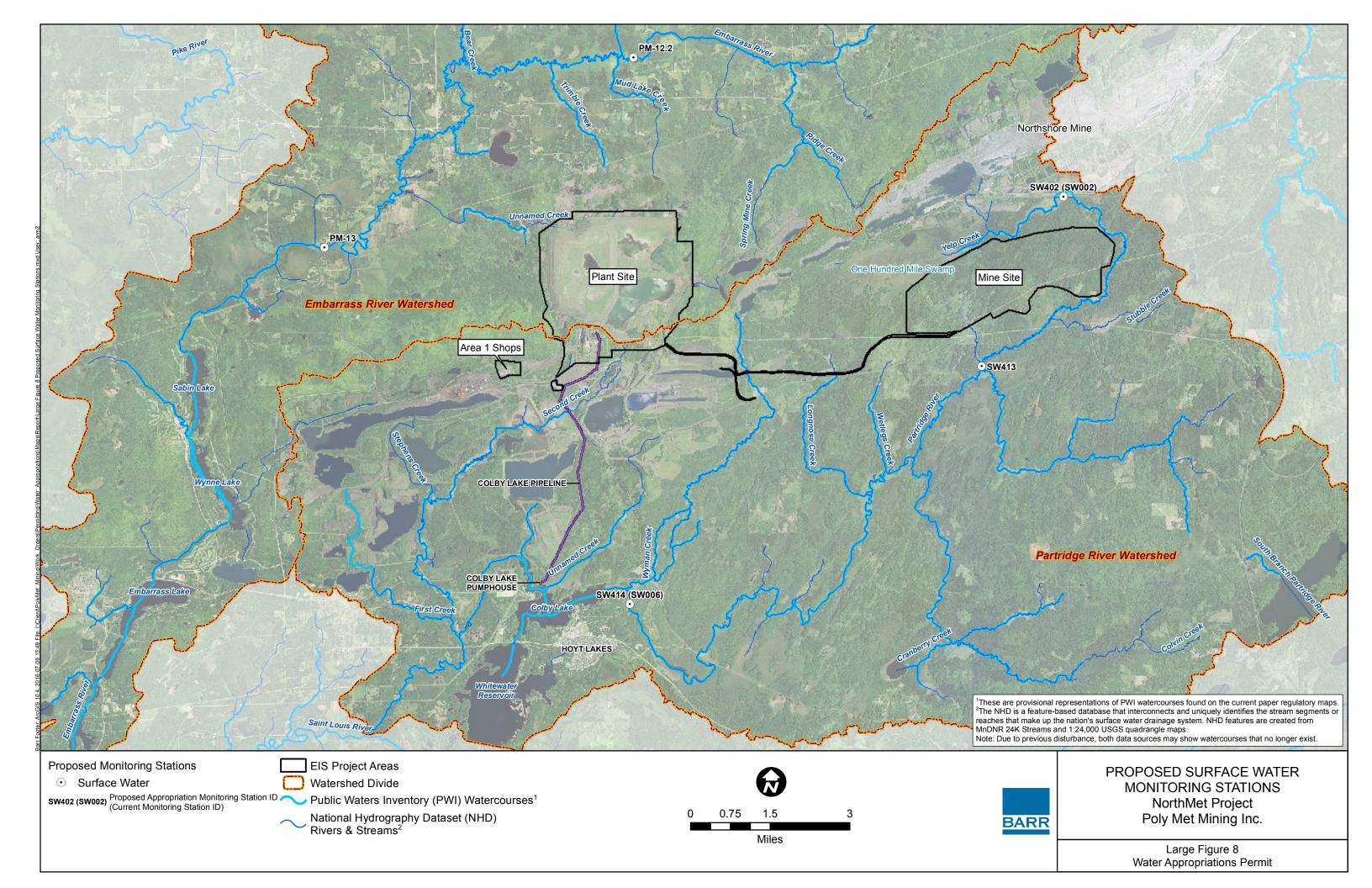
NorthMet Project Poly Met Mining Inc.

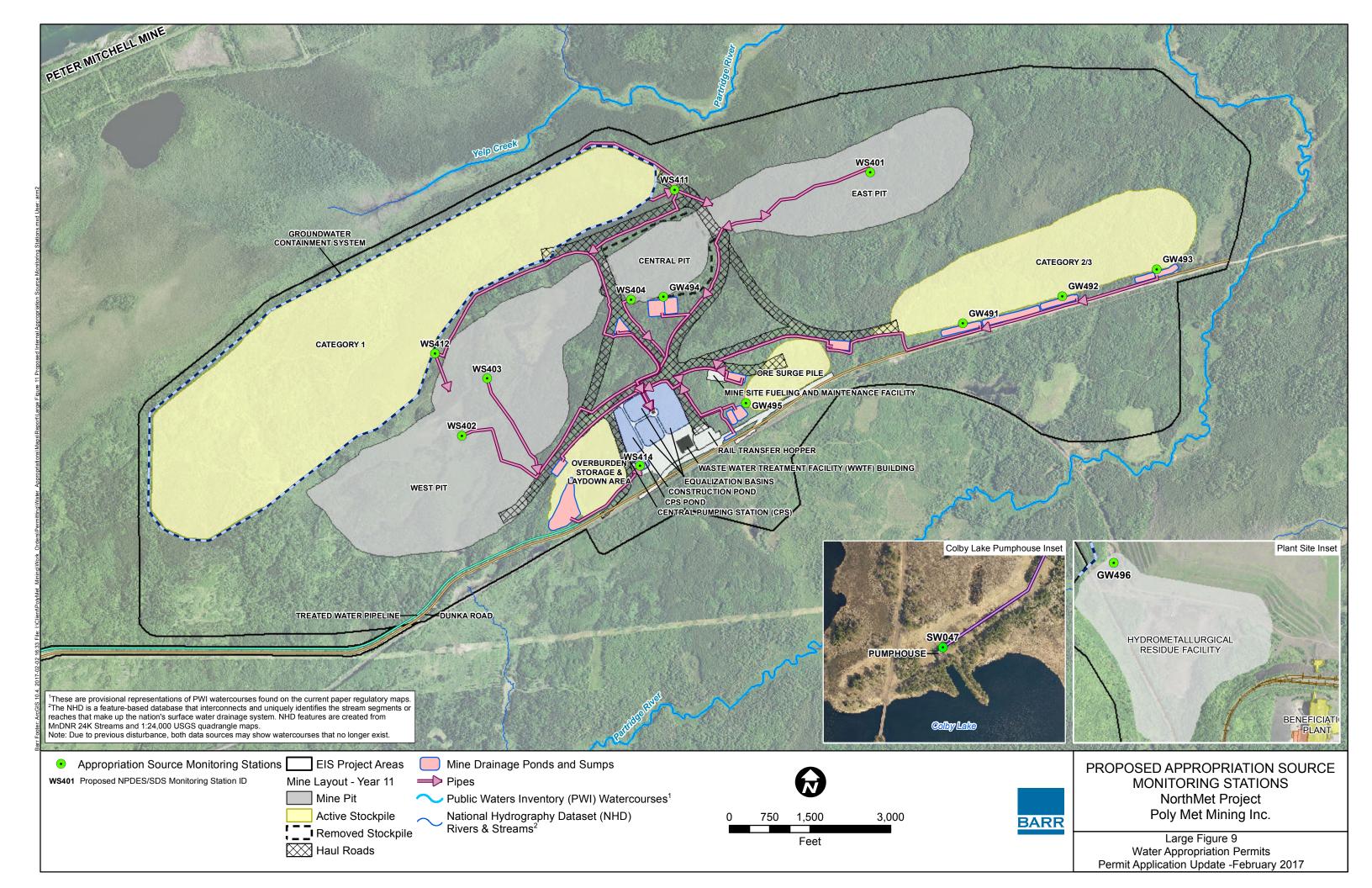
Large Figure 4 Water Appropriations Permit

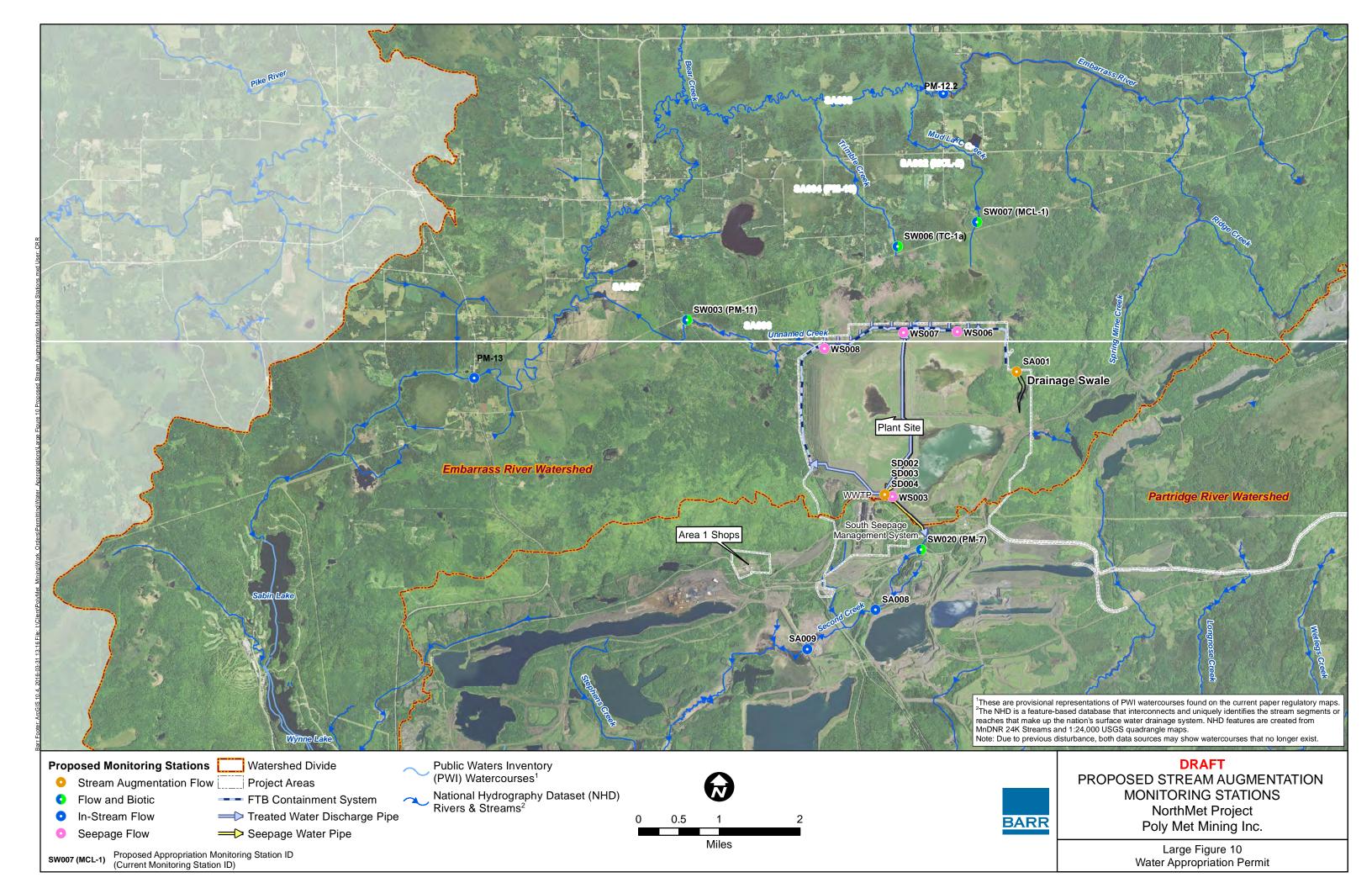


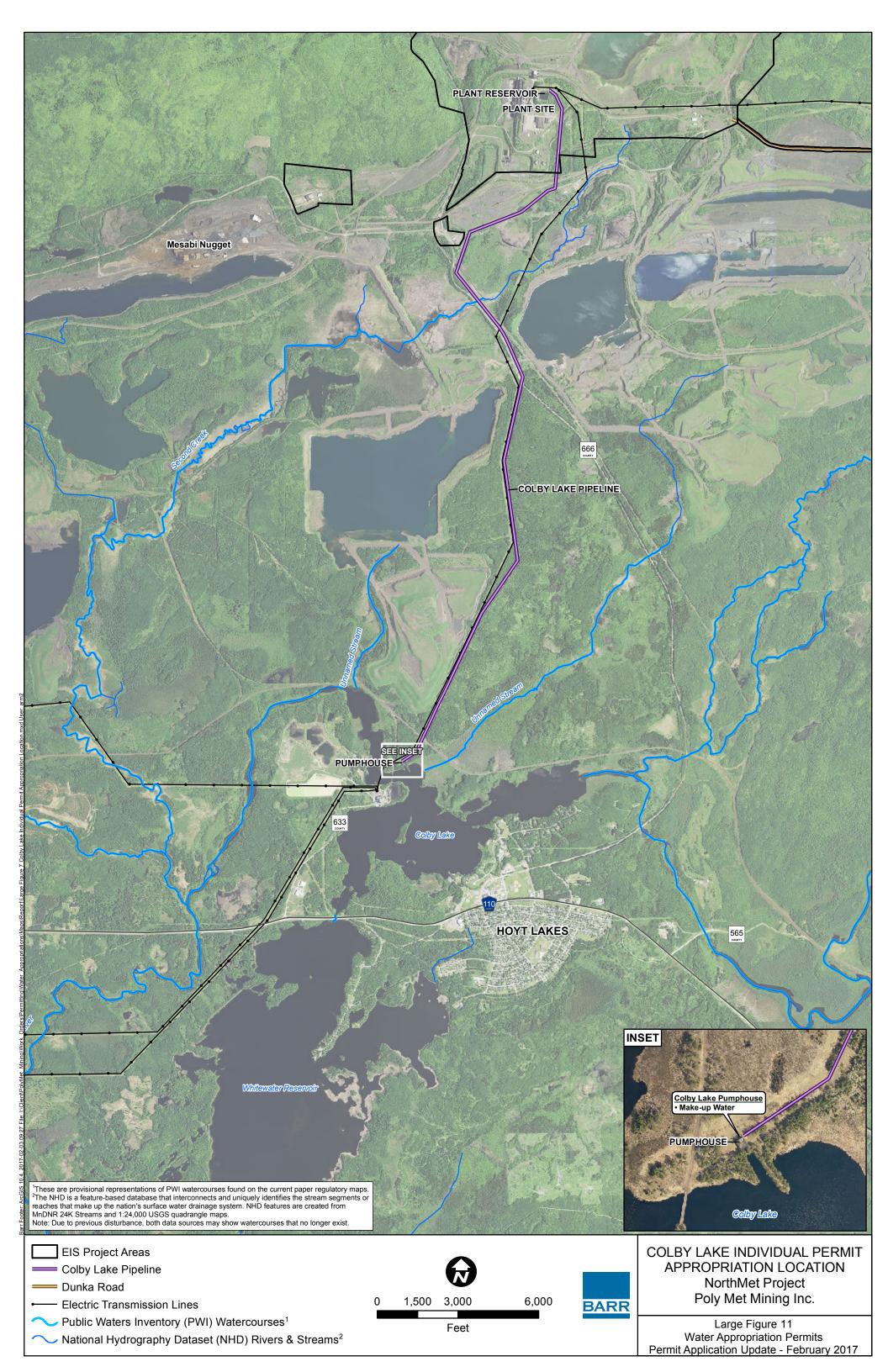












Appendices

Appendix A Application Forms



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

2000	P.A. No.	
		Date(s) Served
	☐ SWCD_	
	□WSD _	
	CITY _	

NOTICE OF WARNING: All information provided on this form is considered to be public information in accordance with the Minnesota Data Privacies Act (M.S. 15.1611 to 15.1698).

SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

Applicant Name (landowner or renter)			2	2. Business Name						
Poly Met Min	J.			Poly Met Mining, Inc.						
3. Authorized Agent	(if applicable)		4	4. Phone Numbers (with area codes)						
Brad Moore				(218) 471-2150						
5. Mailing Address			(6. City, State, Zip Code						
PO Box 475				Н	oyt La	kes, MN 55750				
7. Purpose (Explain		, –	Public Water Supply	-			☐ Water I	_evel N	laintenance	
Pollution Con		☐ Temporary (1			Other					
8. Source of Water ("X" one and comple	suppl	onal information MUST be ied for each source.			of Taking/Pumping Site				
a. One well			to instructions (8 & 9) for ements.			1/4 of1/4 c				
b 1						Section No. 2				
c. ☐ Stream, ditch,				-		Township No. 59				
		name)		-		•				
e. X Other East P	it: overburden	stripping and p		$-\bot$		County St. Louis				
10. Means of Taking	and Rate	11. Method of Measurement	12. Means of Distr			13. Legal Description-La	and Owned/R	ented '	c .	
a. X Stationary Pum	p(s) at <u>TBD</u> gpm	a. X Flow Meter	a. pipe diar	m	length	Township Range No. No.	Section		actional Sect. Gov't. Lots	
b. Portable Pump		b. Timing Device	b. ☐ tank	_						
c. Gravity Flow at	00000	c. Electric Power	c. C channel		length	1				
d. Other		Consumption	d.⊠ other <u>TBD</u>							
d		d. Other								
14. Months of 1	UE Cabadala af A		1 2 2 2 2				****			
		propriation ("X" one								
	ı.⊠ Continuous _		ys/momo./yr.			* Rental Agreement MUST E	Be Submitted			
□FEB □AUG	o.□ Seasonal	Beginning date TE	3D	17.	Dischar	ge To and Quantity				
MAR SEP	. Temporary	End date TBD		a. Stream, Ditch or River () MG'						
	16. Total Annual	Use (Gallons per Ye	ar)	b. Wetland, Lake or						
□APR □OCT	1 000 millio	on gallons per y	, ,oar		120	undment(name)		() MGY	
□MAY □NOV		annual pumpin		с. 🗆] Sewer	System		() MGY	
□JUN □DEC	(maximam	annaar pampir	197	d. 🛚	Other	Flotation Tailings Basin			(1,000) MGY	
18. Discharge Point	TBD	19. Means of Disch	arge and Rate			20. Additional Requiremen	its:			
a1/4 of	1/4 of1/4	astation	nary pump(s) at	g	gpm ea.	a. Map or Air Photo whi				
b. Section No	-	b port	able pump(s) at	9	pm ea.	 Point of Taking or Test Hole Location 			of Property	
c. Township No		c. Gravity Flow at		g	gpm/cfs	Controlled and Ar	ea of Úse 👍	4) Discl	harge Point	
d. Range No		d. X Other TBD		_	gpm/cfs	b. X \$150 Minimum Appli		ıll be bi	lled after	
e. County					rcle one)	c. X Statement of Justific	ation/Alterna	tive So	urces	
						d. X Additional Documen	ts Required			

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
I have	7/11/16



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

P.A. No.	
	Date(s) Served
☐ SWCD	NAME OF THE OWNER, WHICH THE OWNER, WHIC
□WSD _	
□CITY _	

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SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

Applicant Name (landowner or renter) Poly Met Mining, Inc.			2. Business					
, , , , , , , , , , , , , , , , , , , ,			Poly Met Mining, Inc.					
3. Authorized Agent (if applicable) Brad Moore	4	4. Phone Numbers (with area codes) (218) 471-2150						
5. Mailing Address		6. City, State						
PO Box 475			150	akes, MN 55750				
7. Purpose (Explain what the water w	ill be used for)	Public Water Suppl			☐ Water I	evel N	Maintenance	
☐ Pollution Containment	☐ Temporary (1			-				
8. Source of Water ("X" one and com		ional information MUST be lied for each source.	0.70111	of Taking/Pumping Site				
a. One well	Refe	r to instructions (8 & 9) for rements.		1/4 of1/4 o				
b manifolded wells				Section No. 2, 3				
c. ☐ Stream, ditch, or river (name)_			1	Township No. 59				
d. Wetland, lake, or impoundment	(name)	() () () () () () () () () () () () () (d.	Range No. 13				
e.⊠ Other Central Pit: overbu	den stripping an	ıd pit dewaterir	ig e.	County St. Louis				
10. Means of Taking and Rate	11. Method of Measurement	12. Means of Distr	ribution	13. Legal Description-La	nd Owned/R	ented	*	
a. 🛛 Stationary Pump(s) at TBD gpm		a. pipe diar	mlengt	h Township Range No. No.	Section		actional Sect. Gov't. Lots	
b. ☐ Portable Pump at gpn		b. tank	_gal. capacit	у				
c. Gravity Flow atgpm/cfs		c. Channel	lengtl	n				
d. Other gpm/cfs	Consumption	d.X other TBD	W	-				
	d. Other							
14. Months of 15. Schedule of	Appropriation ("X" one	and complete)						
	hrs./dayda							
I I JUL				* Rental Agreement MUST B	e Submitted			
□ FEB □ AUG □ Seasonal	Beginning date T	ви	III Distrikgs to the equality					
C. Temporary	End date TBD		a. Stream, Ditch or River			() MGY	
	al Use (Gallons per Ye	ear)	b.			,) MOV	
(75 maillin	n gallons per ye	ar	Impoundment(name)			() MGY	
(mayimum	(maximum annual numping)		c. ☐ Sewer System			() MGY	
Goot Gpcc	-, ' '		d. X Other	Flotation Tailings Basin)			(700) MGY	
18. Discharge Point TBD	19. Means of Disch	narge and Rate		20. Additional Requiremen				
a1/4 of1/4 of1/4	astatio	nary pump(s) at	gpm ea.	a. Map or Air Photo whi1) Point of Taking or		•		
b. Section No	- b por	table pump(s) at	gpm ea.	2) Test Hole Location	n 3) Bound	daries o		
c. Township No.	c. Gravity Flow at		gpm/cfs	Controlled and Are b. X \$150 Minimum Appli				
d. Range No.	d. X Other TBD			receipt of application	1.			
e. County	-		(circle one)	c. X Statement of Justific d. X Additional Document		tive So	urces	
				Zu				

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
By More	7/11/16



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

P.A. No.		
	Date(s) Served	
☐ SWCD_		
□WSD _		
□ CITY _		

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SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

Applicant Name (landowner or renter)			12	2. Business Name					
Poly Met Mi	ning, Inc.			Poly Met Mining, Inc.					
3. Authorized Agent	t (if applicable)		4	4. Phone Numbers (with area codes)					
Brad Moore				(218) 471-2150					
5. Mailing Address				3. City, State	D 150				
PO Box 475					akes, MN 55750		10 Text 2 months (1947).	N. Shrine	
7. Purpose (Explain				y X	Commercial/Industrial	☐ Water L	evel N	Maintenance	
Pollution Co		☐ Temporary (1			-				
8. Source of Water	("X" one and compl	suppi	ional information MUST be lied for each source.	0.10111	of Taking/Pumping Site				
a. One well		Refer requir	to instructions (8 & 9) for rements.		1/4 of1/4 of				
b				1					
c. ☐ Stream, ditch			White the second	1					
	e, or impoundment (•				
e. X Other_vvest	Pit: overburge	n stripping and			County_St. Louis			***	
10. Means of Taking	g and Rate	11. Method of Measurement	12. Means of Dist		13. Legal Description-Land	d Owned/Re			
a. X Stationary Pur	mp(s) at <u>TBD</u> gpm	a. X Flow Meter	a. pipe diar		INO. INO.	Section		actional Sect. Gov't. Lots	
b. Portable Pum	p at gpm	b. Timing Device	b. tank	_gal. capaci	у				
c. Gravity Flow a	atgpm/cfs	c. Electric Power	c. Channel	lengt	ו				
d. Other		Consumption	d.⊠ other <u>TBD</u>				-10.00		
	(circle one)	d. Other							
14. Months of	15 Schedule of Ar	ppropriation ("X" one	and complete)						
Appropriation		hrs./dayda							
I I JUL I		Beginning date T			* Rental Agreement MUST Be S	Submitted			
□FFR □AUG	b.☐ Seasonal	/	30						
□MAR □SEP	c. Temporary	End date TBD		a. Stream, Ditch or River			() MGY	
□APR □OCT	16. Total Annual	Use (Gallons per Ye	ear)	b. ☐ Wetland, Lake or			,	\ MOV	
□MAY □NOV	200 milli	on gallons per v	/Oar	Impoundment(name)			() MGY	
		m annual pump		c. ☐ Sewer System d. ☒ Other Flotation Tailigs Basin)			() MGY	
				d. X Other	Tiotation raings basinj			(800) MGY	
18. Discharge Point	ן עסו	19. Means of Disch	arge and Rate		20. Additional Requirements:				
a1/4 of	1/4 of1/4	astation	nary pump(s) at	gpm ea.	a. Map or Air Photo which				
b. Section No b portable pump(s) at			table pump(s) at	gpm ea.	 Point of Taking or Pu Test Hole Location 	3) Bounda	aries c		
c. Township No c. Gravity Flow at				gpm/cfs	Controlled and Area b. X \$150 Minimum Applica	of Use 4) Disc	harge Point	
d. Range No		d. X Other TBD			receipt of application.				
e. County				(circle one)	 c. ∑ Statement of Justification d. ∑ Additional Documents I 		ve So	urces	
					C. L. Additional Documents I				

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
Bot there	7/11/16



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

P.A. No.	
SWCD_ WSD _ CITY _	Date(s) Served

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SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

1. Applicant Name (lar		·)	2		Business I					
Poly Met Minii	ng, Inc.			Poly Met Mining, Inc.						
3. Authorized Agent (if	f applicable)		4			mbers (with area co	odes)			
Brad Moore				(218) 471-2150						
5. Mailing Address			(Zip Code				
PO Box 475					Hoyt La	kes, MN 5575	50			
7. Purpose (Explain w	hat the water will	be used for)	Public Water Suppl	У		Commercial/Indust	rial	☐ Water	Level N	faintenance
Pollution Conta		Temporary (1			Other		~			
8. Source of Water ("X	C" one and comple	suppli	onal information MUST be ied for each source.	•		of Taking/Pumping			e appli	ication text
a. ☐ One well			to instructions (8 & 9) for rements.			1/4 of				
b m	nanifolded wells					Section No				
c. ☐ Stream, ditch, or	r river (name)					Township No				
d. Wetland, lake, o				_	d.	Range No.				
e.⊠ Other Mine Si	te Intrastruct]		e.	County				
10. Means of Taking ar	nd Rate	11. Method of Measurement	12. Means of Dist	ribut	tion	13. Legal Descr	•	d Owned/F	Rented ³	*
a. X Stationary Pump	(s) at <u>TBD g</u> pm	a. 🗌 Flow Meter	a. pipe diar	m	length	Township R	Range No.	Section		actional Sect. Gov't. Lots
b. X Portable Pump a		b. ☐ Timing Device	b. tank	_ga	I. capacity	/				
c. ☐ Gravity Flow at_		c. Electric Power	c. C channel		length					
d. Other		Consumption	d.⊠ other TBD							
u. Duller	0.	various, se d. ☑ Otherapplicatio	e							
Appropriation		propriation ("X" one								
	_	hrs./dayda				* Rental Agreemen	t MUST Be	Submitted		
□FEB □AUG b.[☐ Seasonal	Beginning date TE	3D	17	. Dischar	ge To and Quantity	/			
C.[☐ Temporary /	End date TBD		a.	☐ Stream	n, Ditch or River	(name)		() MGY
MAR SEP	16. Total Annual	Use (Gallons per Ye	ar)	b.	☐ Wetlar	nd, Lake or	(name)			
□APR □OCT			,		Impor	ındment	name)		() MGY
□MAY □NOV		n gallons per ye		C.	☐ Sewer					(various) MGY
□JUN □DEC	(maximum	annual pumpi	ng)	d.	X Other	Various, see a	application	on text		(various) MG1
18. Discharge Point \	Various	19. Means of Disch	arge and Rate			20. Additional Req	uirements	:		
a1/4 of1/-	/4 of1/4	astation	nary pump(s) at		gpm ea.	a. Map or Air Pl	hoto which	ı shows:		
b. Section No		b port				1) Point of T 2) Test Hole				of Proporty
c. Township No		c. Gravity Flow at				Controlled	d and Area	of Use	4) Disc	harge Point
d. Range No.	1	d. X Other TBD			gpm/cfs	b. X \$150 Minimoreceipt of an		ation Fee w	ill be b	illed after
e. County					circle one)	c. X Statement o	f Justificat		itive So	urces
e. County			The second secon			d. X Additional D	ocuments	Required		
I be a selection of the second	lt 41		01 4000 00							

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
By three	7/11/16



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

P.A. No.	
	Date(s) Served
☐ SWCD	
□WSD	
□ CITY	

NOTICE OF WARNING: All information provided on this form is considered to be public information in accordance with the Minnesota Data Privacies Act (M.S. 15.1611 to 15.1698).

SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

Applicant Name (landowner or renter) Poly Met Mining, Inc.			2. Business Name Poly Met Mining, Inc.				
3. Authorized Agent (if applicable)			4. Phone Numbers (with area codes)				
			(218) 471-2150				
Brad Moore 5. Mailing Address		6	6. City, State				
PO Box 475				akes, MN 55750			
7. Purpose (Explain what the water will	be used for)	Public Water Supply			☐ Water Leve	l Maintenance	
☐ Pollution Containment	☐ Temporary (1	<u> </u>		•			
8. Source of Water ("X" one and comple	supplie	nal information MUST be ed for each source.	9. Point	of Taking/Pumping Site	Various, see a	oplication text	
a. One well	Refer to require	o instructions (8 & 9) for ments.		1/4 of1/4 of			
b manifolded wells				Section No.		_	
c. Stream, ditch, or river (name)				Township No.			
d. Wetland, lake, or impoundment (r				Range No.		_	
e. Other Plant Site Infrastruct				County		_	
10. Means of Taking and Rate	Measurement	12. Means of Distr		13. Legal Description-L	and Owned/Rente		
a. Stationary Pump(s) atgpm	a. Flow Meter	a pipe diar		140.	Section	Fractional Sect. Gov't. Lots	
b. ☒ Portable Pump at TBD gpm	b. Timing Device	b. ☐ tank	-				
c. Gravity Flow atgpm/cfs	c. Electric Power	c. channel	_	n			
d. ☐ Other gpm/cfs Consumption d. ☒ other							
(circle one)	various, see d. 🛚 Otherapplication	9					
	propriation ("X" one a	and complete)	ASSESSED FOR SE				
	b. Seasonal Beginning date TBD c. Temporary End date TBD			* Rental Agreement MUST I	Be Submitted		
			17. Discharge To and Quantity				
FEB AUG c. Temporary			a, □ Stream Ditch or River () M				
MAR SEP			b. Wetland, Lake or				
APR LIUCI				undment(name)	() MGY	
1	gallons per year		c. ☐ Sewer System () MG				
□JUN □DEC (maximum a	annual pumping)	d. ☑ Other Various, see application text (various) N			(various) MGY	
18. Discharge Point Various	19. Means of Discha	arge and Rate		20. Additional Requirement	nts:		
a1/4 of astationary pump(s) at		ary pump(s) at	gpm ea.	a. Map or Air Photo wh			
b. Section No bportable pump(s) at			1) Point of Taking or Pumping Site 2) Test Hole Location 3) Boundaries of Property			s of Property	
c. Township No c. Gravity Flow at			gpm/cfs	Controlled and Ar	rea of Use 4) D	ischarge Point	
d. Range No d. 🗵 Other TBD			gpm/cfs	 b. ☒ \$150 Minimum Appropriate b. ☒ \$150 Minimum Appropriate 	n.		
e. County			(circle one) c. ☒ Statement of Justification/Alternative Sources d. ☒ Additional Documents Required			Sources	
				and the second s			

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
A home	7/11/16



Permit Application for Appropriation of Waters of the State NON-IRRIGATION

P.A. No.
Date(s) Served
☐ SWCD
□WSD
CITY

NOTICE OF WARNING: All information provided on this form is considered to be public information in accordance with the Minnesota Data Privacies Act (M.S. 15.1611 to 15.1698).

SEE INSTRUCTIONS...TYPE OR PRINT CLEARLY

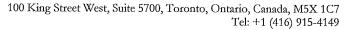
, , ,			2. Business Name					
Poly Met Mining, Inc.			PolyMet Mining Corp. (parent company)					
3. Authorized Agent (if applicable)			4. Phone Numbers (with area codes)					
Brad Moore		. ,	71-2150					
5. Mailing Address		6	6. City, State	•				
PO Box 475		5	-	akes, MN 55750				
7. Purpose (Explain what the water v	lli be used for) □ [] Temporary (1]		_	Commercial/Industrial	vvater Le	vei Maintenance		
8. Source of Water ("X" one and com	plete) > Addit	ional information MUST be lied for each source.	9. Point	of Taking/Pumping Site				
a. One well	Refe	r to instructions (8 & 9) for rements.		<u>SE_1/4 ofSE_1/4 of</u>				
b manifolded wells		rements.		Section No. 6				
c. ☐ Stream, ditch, or river (name)_				Township No. 58				
d.☐ Wetland, lake, or impoundmen	t (name)			Range No. <u>14</u>				
e.図 Other Colby Lake			е.	County St. Louis				
10. Means of Taking and Rate	11. Method of Measurement	12. Means of Dist		13. Legal Description-L	and Owned/Rei	nted *		
a. ☑ Stationary Pump(s) at <u>TBD</u> gpr		a.⊠ pipe <u>36 in</u> dia	_	140.	Section	Fractional Sect. Gov't. Lots		
b. ☐ Portable Pump at gpi	'	b. tank		·				
c. Gravity Flow atgpm/cf	s c. Electric Power	c. C channel	-					
d. Other gpm/cfs Consumption d. other			-			_		
	e) d. 🗌 Other				i			
14. Months of 15. Schedule of	Appropriation ("X" one	and complete)					_	
1 A 1 ()	hrs./dayd	• •		* Pontal Agraement MUCT	Do Cubmitted		_	
□JAN □ JUL b.□ Seasonal	Beginning date T		Trental Agreement Meet be debrined					
FEB AUG c. Temporary								
□MAR □ SEP	·		a. D M-41-	(nar	ne)	() MG	, ,	
APR UCI	nual Use (Gallons per '	•		ind, Lake or undment		() MG	Ϋ́	
	illion gallons pei	-	c. Sewe	(name)		() MG	Ϋ́	
□JUN □DEC (maximum annual pumping)		ing)	d. 🗵 Other Plant Reservoir (1,8					
18. Discharge Point	19. Means of Discl	narge and Rate	•	20. Additional Requireme	nts:			
a. <u>SW</u> 1/4 of <u>SW</u> 1/4 of <u>1/4</u> a. <u>astationary pump(s) at</u>			gpm ea.	a. X Map or Air Photo wh				
b. Section No. 9 b portable pump(s) at			gpm ea.	1) Point of Taking o 2) Test Hole Location		ries of Property		
c. Township No. 59 c. Gravity Flow at			gpm/cfs		rea of Úse 4)	Discharge Point		
d. Range No. 14 d. X Other TBD			gpm/cfs	receipt of application	n.			
e. County			(circle one)	c. 🛛 Statement of Justifi	cation/Alternativ nts Required	e Sources		
L								

I hereby make application pursuant to Minnesota Statutes Chapter 103G.261 and all supporting rules for a permit to appropriate water in accordance with all supporting maps, plans, and other information submitted with this application. The information submitted and statements made concerning this application are true and correct to the best of my knowledge.

21. Signature of Landowner or Authorized Agent	22. Date
Bel proce	2/7/17

Appendix B

Notification to Local Government Officials





6500 County Road 666, Hoyt Lakes, MN 55750-0475 Tel: +1 (218) 471-2150 / Fax: +1 (218) 225-4429

www.polymetmining.com

February 7, 2017

Charles Bainter, Secretary of the Board North St. Louis Soil and Water Conservation District Northland Office Building 307 1st Street South, Suite 114 Virginia, MN 55792

RE: Poly Met Mining, Inc.'s Updated Water Appropriation Permit Application (Version 2) for the NorthMet Project

Dear Mr. Bainter:

Poly Met Mining, Inc.'s (PolyMet) submitted an updated consolidated application to the Minnesota Department of Natural Resources (MDNR) for individual water appropriation permits (Updated Application) for its NorthMet Project (Project). This Updated Application was submitted as Version 2, because it includes a request for an additional water appropriation permit, an appropriation of water from Colby Lake.

We are notifying you of this Updated Application, pursuant to Minnesota Rules 6115.0660, subpart 3(D), as the Project is in North St. Louis County, with portions of the Project outside of municipal boundaries. PolyMet does not expect these appropriations to have an impact on available water supply or area water resources, as described in the FEIS and this Updated Application. The Updated Application will be posted on MDNR's website, and they will be notifying you when it is ready for your review.

This Updated Application is based primarily on the extensive data collection and technical analyses conducted as part of the development of the Final Environmental Impact Statement (FEIS) for the NorthMet Project and Land Exchange. When necessary for the water appropriation permitting process, the Updated Application expands upon such information.

If any questions or concerns arise during your review of this Updated Application, please do not hesitate to contact me at 218-461-7746 or ckearney@polymetmining.com.

Sincerely,

Christie M. Kearney, P.E.



100 King Street West, Suite 5700, Toronto, Ontario, Canada, M5X 1C7 Tel: +1 (416) 915-4149

444 Cedar Street, St. Paul, MN 55101, Tel: +1 (651) 389-4100

6500 County Road 666, Hoyt Lakes, MN 55750-0475 Tel: +1 (218) 471-2150 / Fax: +1 (218) 225-4429

www.polymetmining.com

February 7, 2017

Mayor Mark Skelton City of Hoyt Lakes Municipal Building 206 Kennedy Memorial Drive Hoyt Lakes, MN 55750

RE: Poly Met Mining, Inc.'s Updated Water Appropriation Permit Application (Version 2) for the NorthMet Project

Dear Mayor Skelton:

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6500 County Road 666, Hoyt Lakes, MN 55750-0475 Tel: +1 (218) 471-2150 / Fax: +1 (218) 225-4429

www.polymetmining.com

February 7, 2017

Mayor Andrea Zupancich City of Babbitt 71 South Drive Babbitt, MN 55706

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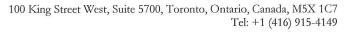
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Sincerely,

Christie M. Kearney, P.E





6500 County Road 666, Hoyt Lakes, MN 55750-0475 Tel: +1 (218) 471-2150 / Fax: +1 (218) 225-4429

www.polymetmining.com

VIA HAND DELIVERY (HARD COPY)

July 11, 2016

Charles Bainter, Secretary of the Board North St. Louis Soil and Water Conservation District Northland Office Building 307 1st Street South, Suite 114 Virginia, MN 55792

RE: Poly Met Mining, Inc.'s Water Appropriation Permit Application for the NorthMet Project

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This Application contains the following materials:

- Documentation on PolyMet's proposed approach to water appropriation permitting;
- Five separate applications for individual water appropriation permits; and
- Supporting figures, tables, and technical information.

This Application is based primarily on the extensive data collection and technical analyses conducted as part of the development of the Final Environmental Impact Statement (FEIS) for the NorthMet Project and Land Exchange. When necessary for the water appropriation permitting process, the Application expands upon such information.

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Sincerely,

Christie M. Kearney, P.E. Environmental Site Director



6500 County Road 666, Hoyt Lakes, MN 55750-0475 Tel: +1 (218) 471-2150 / Fax: +1 (218) 225-4429

www.polymetmining.com

VIA HAND DELIVERY (HARD COPY)

July 11, 2016

Mayor Mark Skelton City of Hoyt Lakes Municipal Building 206 Kennedy Memorial Drive Hoyt Lakes, MN 55750

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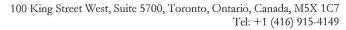
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Sincerely,

Christie M. Kearney, P.E. Environmental Site Director





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www.polymetmining.com

VIA HAND DELIVERY (HARD COPY)

July 11, 2016

Mayor Andrea Zupancich City of Babbitt 71 South Drive Babbitt, MN 55706

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Sincerely,

Christie M. Kearney, P.È

Appendix C

Permit Application Support Drawings

Mine Site and Dunka Road Earthwork

POLY MET MINING, INC. NORTHMET PROJECT

PERMIT APPLICATION SUPPORT DRAWINGS

---1000----

PROPOSED

PROPOSED OTHER FACILITY

OTHER FACILITY PROPOSED CONTOUR - MAJOR

OTHER FACILITY PROPOSED CONTOUR - MINOR

PROPOSED CONTOUR - MAJOR ---1000----PROPOSED CONTOUR - MINOR PROPOSED ROADS

+++++++++ EXISTING RAILROAD

EXISTING

⊗ EXISTING POWER POLE

----- WATER EDGE/CREEK CENTER LINE

EXISTING CONTOUR - MINOR

EXISTING ROAD ---- EXISTING TRAIL

____ EXISTING UNIMPROVED TRAIL

----R/W--- RIGHT OF WAY PROPERTY LINE

--- MINE SITE BOUNDARY

EXISTING STRUCTURES

TREE LINE WETLAND BOUNDARY

--- OE --- EXISTING OVERHEAD ELECTRIC

--- UE --- EXISTING UNDERGROUND ELECTRIC

M EXISTING VALVE

>--- EXISTING CULVERT PROPOSED MINE DRAINAGE CULVERT

NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE,
- 2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.

ABBREVIATIONS

CATEGORY 1 STOCKPILE - CATEGORY 1 WASTE ROCK STOCKPILE CATEGORY 2/3 STOCKPILE - CATEGORY 2/3 WASTE ROCK STOCKPILE

 EARTHWORK EW

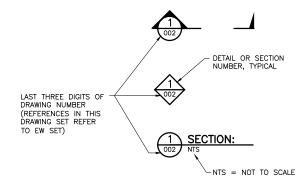
SHEET INDEX

SHEET NO. TITLE

GENERAL DRAWINGS

EW-001 LOCATION MAP AND SITE MAP
EW-002 LEGEND AND SHEET INDEX
EW-003 DUNKA ROAD UPGRADE GENERAL LAYOUT
EW-004 DUNKA ROAD UPGRADE TYPICAL SECTION
EW-005 HAUL ROADS GENERAL LAYOUT – MINE YEAR 11
EW-006 HAUL ROADS TYPICAL SECTIONS AND DETAILS
EW-007 HAUL ROADS TYPICAL SECTIONS AND DETAILS
EW-008 PRE-STRIPPING PIT TYPICAL SECTION
EW-009 OVERBURDEN STORAGE AND LAYDOWN AREA GRADING PLAN
EW-010 HAUL ROAD CLOSURE PLAN MINE YEARS 1-11
EW-011 HAUL ROAD CLOSURE PLAN MINE YEARS 11-20

DRAWING NUMBERING



PLANT DRAWING NUMBER:

POLYME

MINE SITE & DUNKA ROAD EARTHWORK LEGEND AND SHEET INDEX

BARR

EW-002

POLY MET MINING, INC. NORTHMET PROJECT

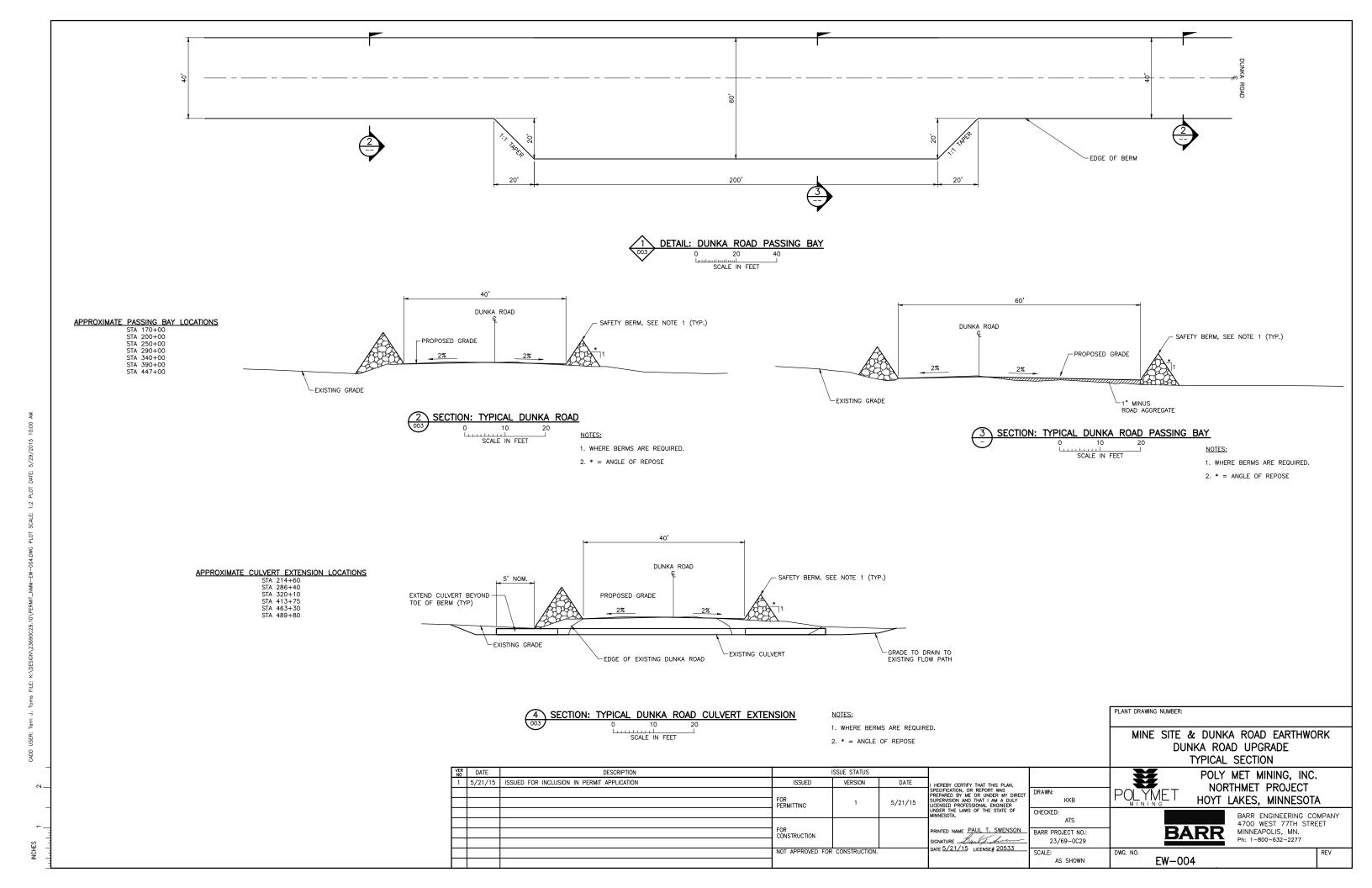
HOYT LAKES, MINNESOTA

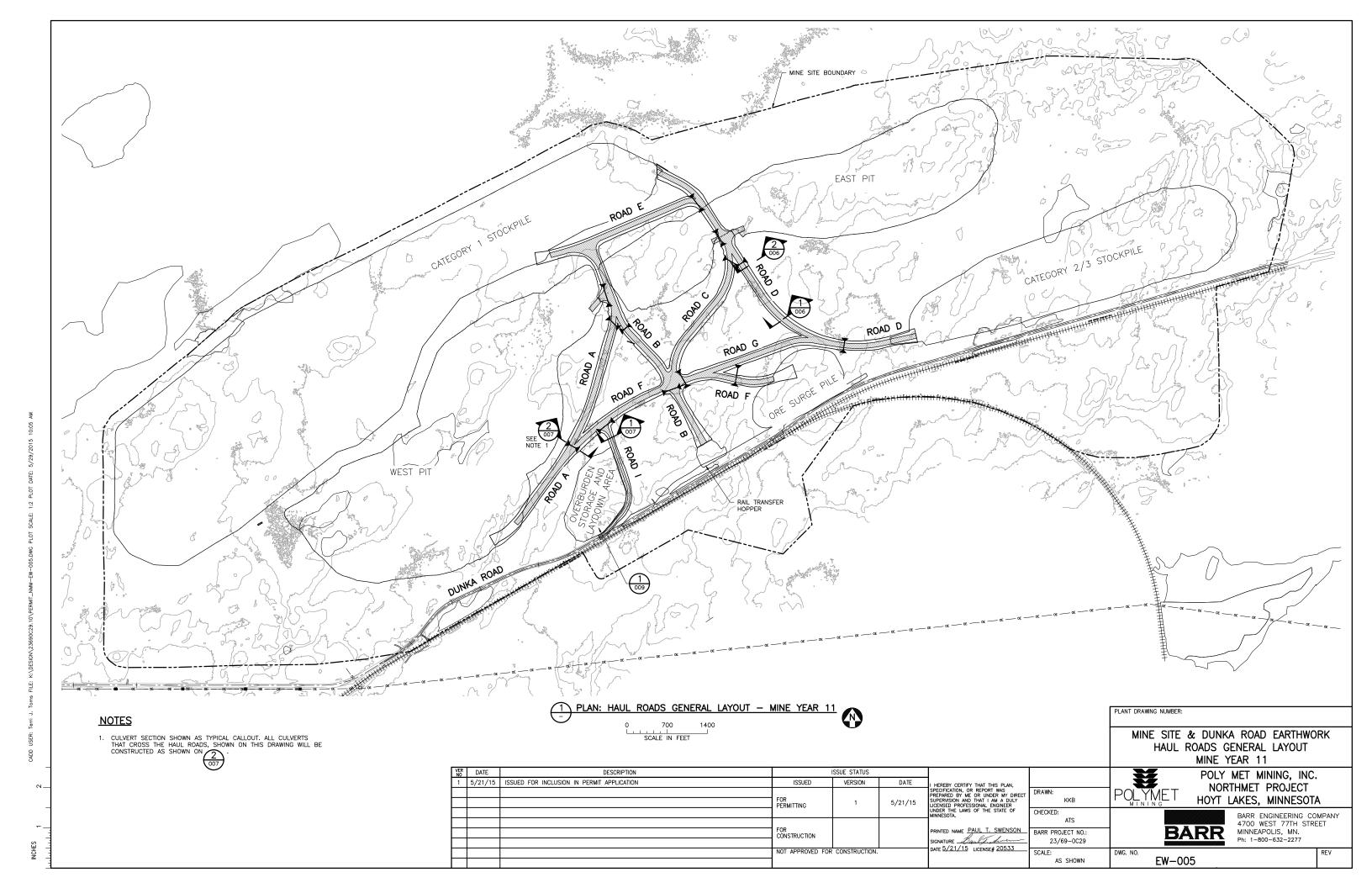
MINNEAPOLIS, MN.

Ph: 1-800-632-2277

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET

VER NO	DATE	DESCRIPTION		ISSUE STATUS			
1	5/21/15	ISSUED FOR INCLUSION IN PERMIT APPLICATION	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.	
			FOR PERMITTING	1	5/21/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: KKB
			T ERWITTING			UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:
			l				ATS
			FOR CONSTRUCTION		l	PRINTED NAME PAUL T. SWENSON	BARR PROJECT NO.:
						SIGNATURE DATE 5/21/15 LICENSE# 20533	23/69-0029
			NOT APPROVED FOR	CONSTRUCTION.		DATE 3/21/13 LICENSE# 20533	SCALE:
			1				AS SHOWN

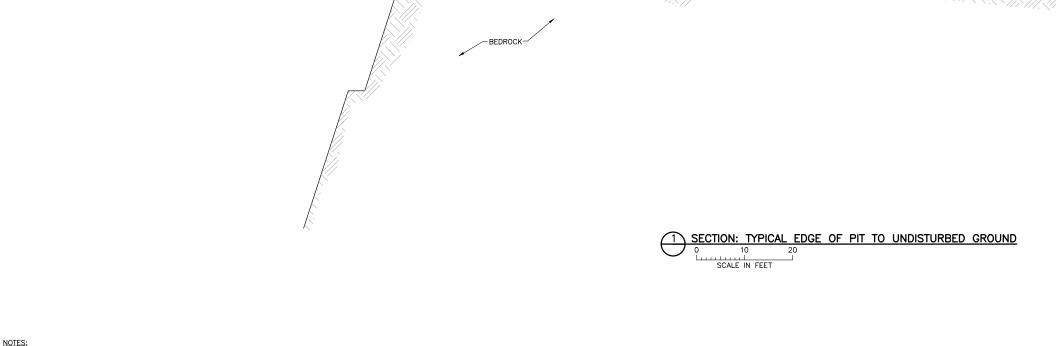




40' ACCESS ROAD







EXISTING GROUND

20' MINIMUM

_EXISTING BEDROCK

PROPOSED FINISHED GRADE WITHIN PRE-STRIPPING AREA REFLECTS BEDROCK DATA PROVIDED BY POLYMET.

2. CONSTRUCT EXCLUSION DIKE AROUND PIT PERIMETER TO DIVERT SURFACE RUNOFF AWAY FROM PIT.

PRE-STRIPPING

MINING

- FINAL PIT SLOPES SHALL ADHERE TO CHAPTER 6132.23 OVERBURDEN PORTION OF PITWALLS OF MINNESOTA DNR STANDARDS.
- 4. SLOPES IN AREAS WHERE ORGANIC SOILS AND WETLANDS ARE PRESENT MAY BE SLOPED AS NECESSARY TO MAINTAIN A STABLE SLOPE.
- 20' BENCH SHALL BE ESTABLISHED FROM THE TOE OF THE OVERBURDEN TO THE FUTURE CREST OF ROCK IN ACCORDANCE WITH MINNESOTA DNR SIDEWALL DESIGN STANDARDS.
- CONTRACTOR SHALL LEAVE TEMPORARY HAUL ROADS WITHIN PRE-STRIPPING LIMITS IN PLACE FOR OWNER'S ACCESS.
- CONTRACTOR SHALL STOCKPILE OVERBURDEN IN LOCATIONS AND AT QUANTITIES TO BE APPROVED BY OWNER.

VER NO	DATE	DESCRIPTION		ISSUE STATUS			
1	5/21/15	ISSUED FOR INCLUSION IN PERMIT APPLICATION	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.	
			FOR PERMITTING	1	5/21/15	PREPARED BY ME OR ONDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME PAUL T. SWENSON SIGNATURE LAWLY JAMES PAUL TO SUPERVISIONAL SIGNATURE LAWLY JAMES PAUL TO SUPERVISIONAL PRINTED NAME PAUL T. SWENSON	DRAWN: KKB
			T Extensive to				CHECKED:
]				ATS
			FOR CONSTRUCTION				BARR PROJECT NO.: 23/69-0C29
			NOT APPROVED FOR	CONSTRUCTION.		DATE 5/21/15 LICENSE# 20533	SCALE:
			1				AS SHOWN

EXCLUSION DIKE, SEE NOTE 2

UNDISTURBED_ OVERBURDEN

MINE SITE & DUNKA ROAD EARTHWORK PRE-STRIPPING PIT TYPICAL SECTION

POLYMET MINING KKB ATS

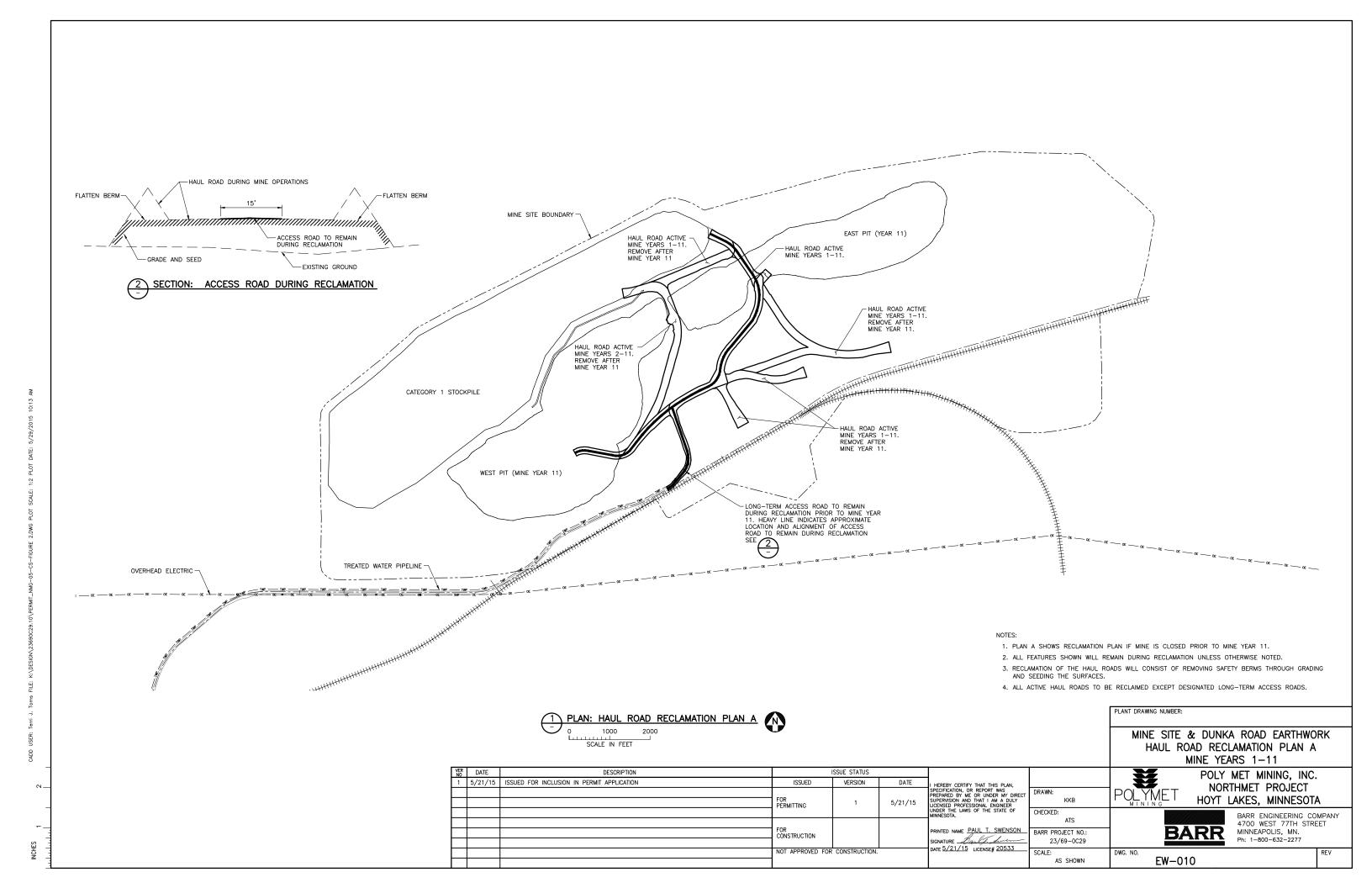
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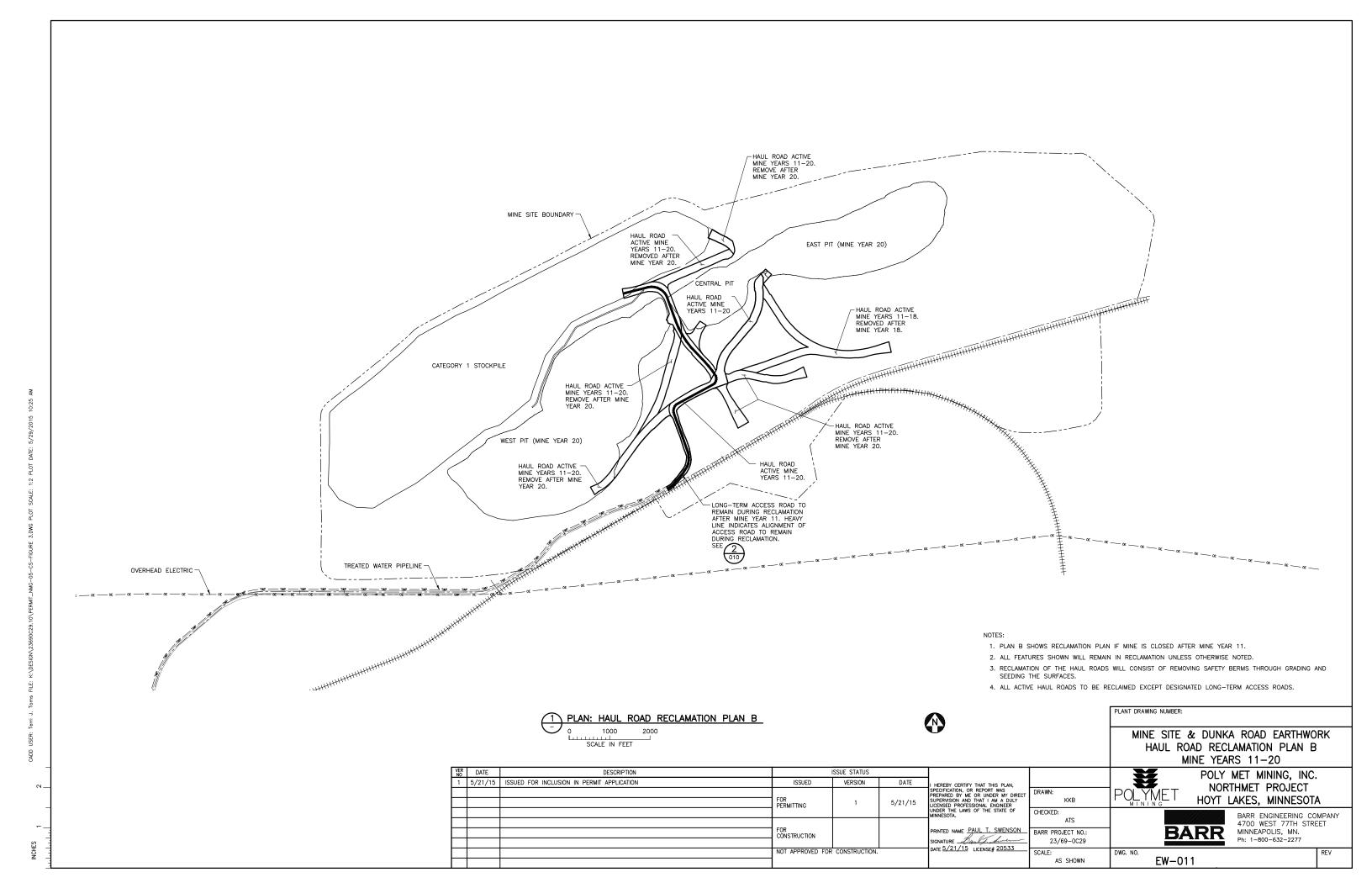
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

EW-008



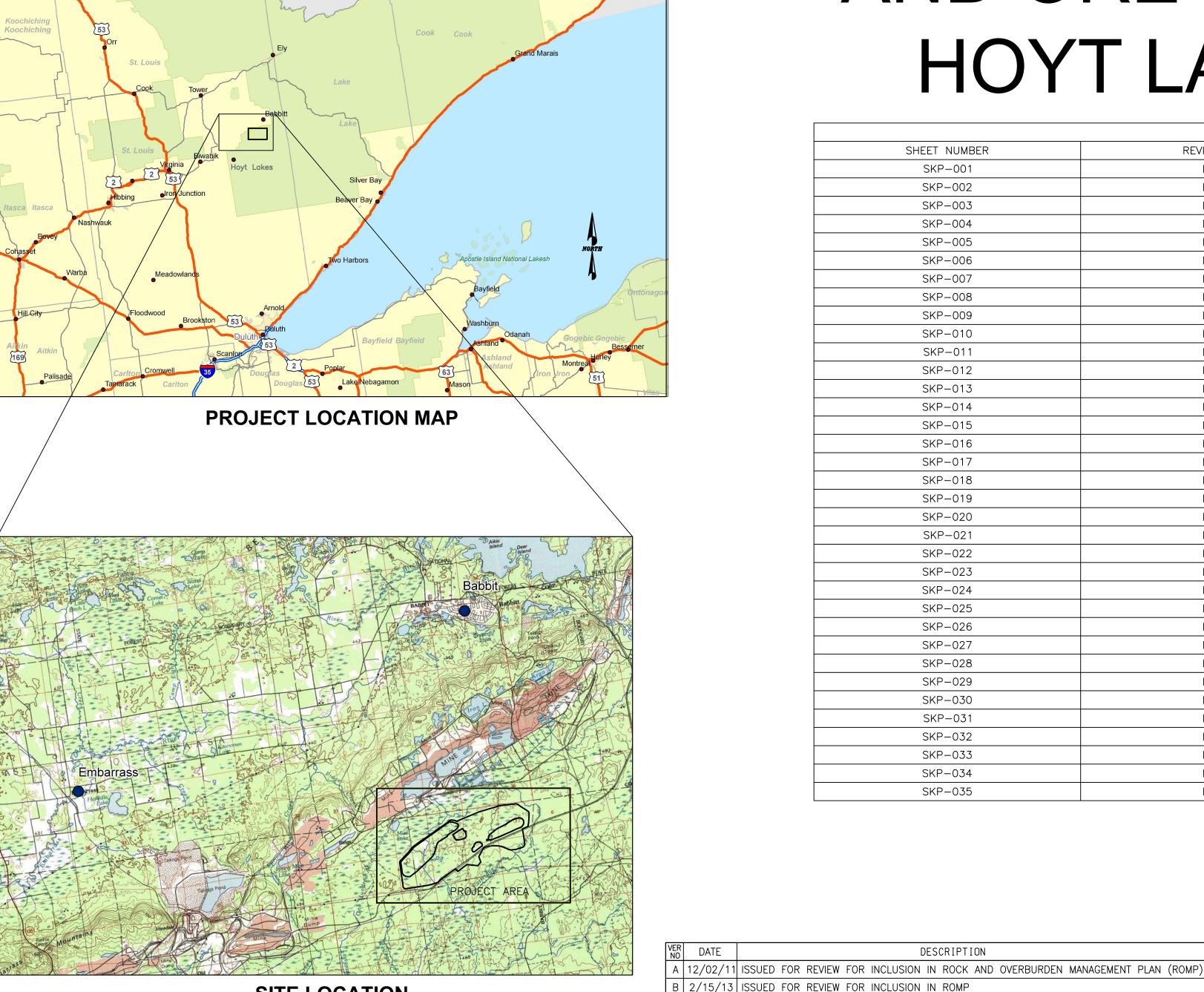


Category 1, 2/3, and 4 Stockpiles and Ore Surge Pile

POLY MET MINING, INC. NORTHMET PROJECT PERMIT APPLICATION SUPPORT DRAWINGS CATEGORIES 1, 2/3, AND 4 STOCKPILES

AND ORE SURGE PILE DESIGN HOYT LAKES, MINNESOTA

		DRAWING LIST
SHEET NUMBER	REVISION	SHEET TITLE
SKP-001	E	TITLE SHEET AND LOCATION MAP
SKP-002	E	LEGEND, GENERAL NOTES AND SPECIFICATIONS
SKP-003	E	STOCKPILE LAYOUTS - MINE YEAR 1 LIMITS
SKP-004	E	STOCKPILE LAYOUTS - MINE YEAR 2 LIMITS
SKP-005	E	STOCKPILE LAYOUTS - MINE YEAR 11 LIMITS
SKP-006	E	STOCKPILE LAYOUTS - MINE YEAR 21 LIMITS CLOSURE CONFIGURATION
SKP-007	E	EXISTING SITE CONDITIONS
SKP-008	E	SITE LAYOUT AND LOCATION OF FIELD INVESTIGATIONS
SKP-009	E	DEPTH TO BEDROCK ISOPACH MAP
SKP-010	E	CATEGORY 1 STOCKPILE SUBGRADE EXCAVATION PLAN
SKP-011	E	CATEGORY 1 STOCKPILE MINE YEAR 1 CONTINGENCY CLOSURE CONFIGURATION
SKP-012	E	CATEGORY 1 STOCKPILE FINAL GRADES AND SUB-BASIN DELINEATION
SKP-013	E	CATEGORY 1 STOCKPILE DESIGN SECTIONS
SKP-014	E	CATEGORY 2/3 STOCKPILE SUBGRADE EXCAVATION PLAN
SKP-015	E	CATEGORY 2/3 STOCKPILE FOUNDATION GRADING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-016	E	CATEGORY 2/3 STOCKPILE UNDERDRAIN PIPING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-017	E	CATEGORY 2/3 STOCKPILE OVERLINER DRAINAGE PIPING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-018	E	CATEGORY 2/3 STOCKPILE MAXIMUM CAPACITY CONFIGURATION
SKP-019	E	CATEGORY 2/3 STOCKPILE DESIGN SECTIONS
SKP-020	E	CATEGORY 4 STOCKPILE SUBGRADE EXCAVATION PLAN
SKP-021	E	CATEGORY 4 STOCKPILE FOUNDATION GRADING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-022	E	CATEGORY 4 STOCKPILE UNDERDRAIN PIPING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-023	E	CATEGORY 4 STOCKPILE OVERLINER DRAINAGE PIPING PLAN - MINE YEAR 1 AND MAXIMUM
SKP-024	E	CATEGORY 4 STOCKPILE MAXIMUM CAPACITY CONFIGURATION
SKP-025	E	CATEGORY 4 STOCKPILE DESIGN SECTIONS
SKP-026	E	ORE SURGE PILE SUBGRADE EXCAVATION PLAN
SKP-027	E	ORE SURGE PILE FOUNDATION GRADING PLAN
SKP-028	E	ORE SURGE PILE UNDERDRAIN PIPING PLAN
SKP-029	E	ORE SURGE PILE OVERLINER DRAINAGE PIPING PLAN
SKP-030	Е	ORE SURGE PILE TYPICAL CONFIGURATION
SKP-031	E	ORE SURGE PILE DESIGN SECTIONS
SKP-032	E	CATEGORY 1 STOCKPILE RECLAMATION AND OPERATIONS SURFACE WATER - MANAGEMENT DETAILS - SHEET 1 OF 2
SKP-033	E	CATEGORY 1 STOCKPILE RECLAMATION AND OPERATIONS SURFACE WATER - MANAGEMENT DETAILS - SHEET 2 OF 2
SKP-034	E	CATEGORY 1 STOCKPILE PHASED COVER DESIGN
SKP-035	E	CONSTRUCTION DETAILS



SITE LOCATION

DATE

C | 5/29/13 | ISSUED FOR REVIEW FOR INCLUSION IN ROMP

E | 4/10/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

D | 1/14/14 | ISSUED FOR AGENCY REVIEW

DESCRIPTION

TITLE SHEET AND LOCATION MAP POLY MET MINING, INC. NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA

PLANT DRAWING NUMBER:

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233 Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

SKP-001

GOLDER PROJECT NO.: F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION PRINTED NAME BRENT R. BRONSON 113-2209 DATE <u>5/22/15</u> LICENSE # 46492 NOT APPROVED FOR CONSTRUCTION. AS SHOWN

ISSUED

PERMITTING

ISSUE STATUS

VERSION

DATE

HFREBY CERTIFY THAT THIS PLAN,

SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT

CHECKED:

SUPERVISION AND THAT I AM A DULY

ICENSED PROFESSIONAL ENGINEER

IINNESOTA.

JNDER THE LAWS OF THE STATE OF

SLOPE DIRECTION

MAJOR FEATURE

EXISTING GROUND TOPOGRAPHY (SEE NOTE 2)

PROPOSED FINISHED GRADE TOPOGRAPHY

- CROSS SECTION IDENTIFIER SHEET WHERE SECTION IS LOCATED SLOPE

> HAUL ROADS MINE SITE BOUNDARY

> > PIT BOUNDARY

 MINE YEAR 1 ORE, WASTE ROCK STOCKPILE LIMITS — — — — MAXIMUM ORE, WASTE ROCK STOCKPILE LIMITS GEOMEMBRANE BARRIER LAYER

SOIL LINER 1

PREPARED SUBGRADE

SOIL LINER 2

STRUCTURAL FILL

WASTE ROCK OR ORE

GRANULAR DRAINAGE MATERIAL 1 COMMON FILL 1

RIPRAP

DRAIN ROCK

RANDOM FILL

OVERBURDEN MATERIAL

VERTICAL PERCOLATION LAYER (USCS - ML)

LATERAL DRAINAGE LAYER (USCS - SP OR SM)

TERTIARY COLLECTION PIPING

4-INCH

6-INCH

10-INCH 12-INCH

PRIMARY AND SECONDARY COLLECTION PIPING _____ 4-INCH

_____ 8-INCH

LIST OF ABBREVIATIONS

ABOVE MEAN SEA LEVEL CUBIC YARD CY DIAMETER DIA. ELEVATION

FEET HIGH DENSITY POLYETHYLENE INSIDE DIAMETER

MAX. AMERICAN ENGINEERING TESTING, INC. MIN.

SHALLOW MARSH

SHRUB SWAMP

BOREHOLES (2010)

CONIFEROUS SWAMP

GOLDER ASSOC. TEST PIT (2006)

BARR ENGINEERING BOREHOLES (2005)

BARR ENGINEERING BOREHOLES (2008)

HARDWOOD SWAMP

CONIFEROUS BOG

GATP-06-7-

SB-05-01

RS-11-

SEDGE MEADOW

OPEN BOG

EVAPOTRANSPIRATION

LINEAR LOW DENSITY POLYETHYLENE LEAK COLLECTION AND RECOVERY SYSTEM LCRS MAXIMUM

MINIMUM N.T.S. NOT TO SCALE OUTSIDE DIAMETER OD SQUARE YARD

TYP. **TYPICAL** ROMP ROCK AND OVERBURDEN MANAGEMENT PLAN USCS UNIFIED SOIL CLASSIFICATION SYSTEM PERFORATED CORRUGATED POLYETHYLENE CPEP

GENERAL NOTES:

- THIS DRAWING SET REPRESENTS THE DESIGN FOR PERMITTING FOR CATEGORY 1 STOCKPILE, CATEGORY 2/3 STOCKPILE. CATEGORY 4 STOCKPILE AND ORE SURGE PILE FOR THE POLYMET NORTHMET PROJECT IN HOYT LAKES, MINNESOTA, PREPARED IN SUPPORT OF A PERMIT TO MINE. THE DRAWING SET ONLY INCLUDES INFRASTRUCTURE ASSOCIATED WITH THE MOVEMENT OF ROCK (STOCKPILES, PITS, HAUL ROADS, AND RAIL TRANSFER HOPPER) AND NOT OTHER SUPPORT FACILITIES.
- 2. BASE TOPOGRAPHY PROVIDED BY BARR ENGINEERING IN AUGUST 2011.
- 3. GOLDER ASSOCIATES INC. (GOLDER) IS RESPONSIBLE FOR STOCKPILE DESIGNS WITH BATTERY LIMITS DEFINED BY THE PERIMETER/LINER BERMS AND THE UNDERDRAIN SUMPS.
- 4. AT THE BASIC ENGINEERING LEVEL, LIMITED GEOTECHNICAL DATA EXISTS, PARTICULARLY IN LOWLAND AREAS. ADDITIONAL DATA WILL BE OBTAINED FROM THESE AREAS AFTER THE PERMIT TO MINE IS APPROVED. SUBGRADE EXCAVATION PLANS WERE DEVELOPED USING AVAILABLE INFORMATION, AND WILL BE UPDATED FOR FINAL DESIGN BASED ON RESULTS OF PHASE II GEOTECHNICAL INVESTIGATION.
- 5. EARTHWORK QUANTITIES BASED ON NEAT LINE (I.E., NET CUT/ FILL SHRINKAGE FACTOR = 1.0).
- PREPARED SUBGRADE, AS DEFINED ON THE DRAWINGS, INCLUDES CLEARING, GRUBBING, TOPSOIL REMOVAL, REMOVAL OF GEOTECHNICALLY-UNSUITABLE MATERIALS, MOISTURE CONDITIONING, AND SUBGRADE COMPACTION AS DEFINED IN THE SPECIFICATIONS.
- 7. FOUNDATION PREPARATION ASSUMES THE FOLLOWING GENERAL CONSTRUCTION SEQUENCE: (I) EXCAVATE TO BEDROCK WITHIN LOWLAND AREAS ASSUMING A MAXIMUM DEPTH OF OVER-EXCAVATION OF 20 FEET, OR UNTIL REACHING GEOTECHNICALLY-SUITABLE FOUNDATION SOILS AS DETERMINED BY THE PHASE II GEOTECHNICAL INVESTIGATION. STOCKPILE ORGANIC SOILS AND TILL MATERIAL SEPARATELY FOR FUTURE USE AS RECLAMATION SOILS AND STRUCTURAL FILL; (II) PLACE STRUCTURAL FILL AS REQUIRED TO MEET THE FOUNDATION GRADE REQUIREMENTS WITH GRANULAR SOILS, E.G., CATEGORY 1 WASTE ROCK MATERIAL; (III) ESTABLISH FOUNDATION DRAINAGE AS REQUIRED TO PREVENT EXCESS PORE PRESSURES DURING OPERATION; AND (IV) CONSTRUCT LINER SYSTEM DEPENDENT UPON THE REACTIVITY CATEGORY OF THE STOCKPILE MATERIAL.
- AREAS WITH UNSUITABLE SOILS (LOWLAND AREAS) ARE ASSUMED TO COINCIDE WITH THE PREVIOUSLY IDENTIFIED WETLAND AREAS. HORIZONTAL AND VERTICAL EXTENTS OF LOWLAND AREAS ARE EXPECTED TO BE REVISED BASED ON RESULTS OF PHASE II GEOTECHNICAL INVESTIGATION.
- 9. POST-CONSOLIDATION STOCKPILE SETTLEMENTS WERE ESTIMATED BASED ON LIMITED INFORMATION ON THE CONSOLIDATION PROPERTIES OF SUBGRADE MATERIALS. HENCE, FOUNDATION EXCAVATION AND GRADING PLANS ARE ANTICIPATED TO UNDERGO MINOR MODIFICATIONS BASED ON THE RESULTS OF THE PHASE II GEOTECHNICAL INVESTIGATION TO ENSURE SUFFICIENT DRAINAGE.
- 10. CATEGORY 1 WASTE ROCK STOCKPILE WILL BE RECLAIMED BY PLACEMENT OF A GEOMEMBRANE COVER AT CLOSURE. PRIOR TO CLOSURE, WASTE ROCK CATEGORY 2, 3 AND 4 WILL BE USED TO BACKFILL EAST PIT.
- 11. LIMITS OF DISTURBANCE (I.E., CLEARING LIMITS) ASSUMED TO BE 40 FEET FROM THE FACILITY

SPECIFICATIONS:

- 1. FOR EARTHWORKS COMPONENTS OF THE STOCKPILE DESIGN, REFER TO SECTION 2300 OF THE PROJECT SPECIFICATIONS.
- 2. FOR GEOSYNTHETIC AND PIPING COMPONENTS OF THE STOCKPILE DESIGN, REFER TO SECTION 2272 FOR GEOTEXTILE, 2273 FOR POLYETHYLENE GEOMEMBRANE LINERS, AND SECTION 2610

DATE <u>5/22/15</u> LICENSE # 46492

- 3. QUALITY ASSURANCE REQUIREMENTS FOR STOCKPILE CONSTRUCTION ARE DEFINED IN THE CONSTRUCTION QUALITY ASSURANCE PLAN.
- 4. SPECIFICATION SECTION NUMBERING IS PRELIMINARY.

PLANT DRAWING NUMBER:

LEGEND, GENERAL NOTES AND SPECIFICATIONS

ISSUE STATUS DATE DESCRIPTION A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) ISSUED VERSION DATE HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS
PREPARED BY ME OR UNDER MY DIRECT B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP DRAWN: SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING JNDER THE LAWS OF THE STATE OF D 1/14/14 ISSUED FOR AGENCY REVIEW CHECKED: MINNESOTA. E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS SIGNATURE Allronson F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION PRINTED NAME BRENT R. BRONSON

NOT APPROVED FOR CONSTRUCTION.

MTM GOLDER PROJECT NO.: 113-2209

AS SHOWN

DWG. NO.

SCALE:

芸 NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA Golder

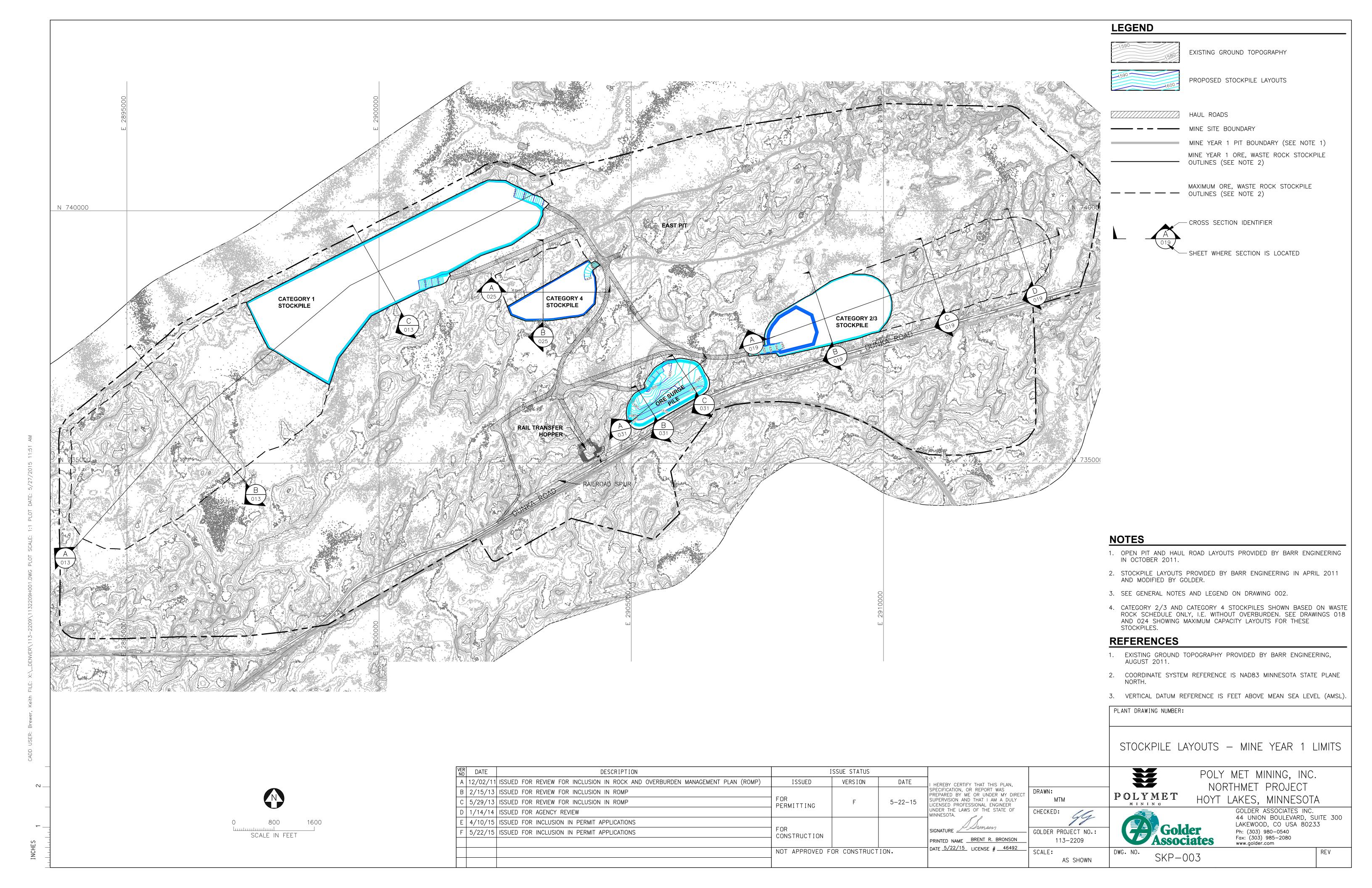
Associates

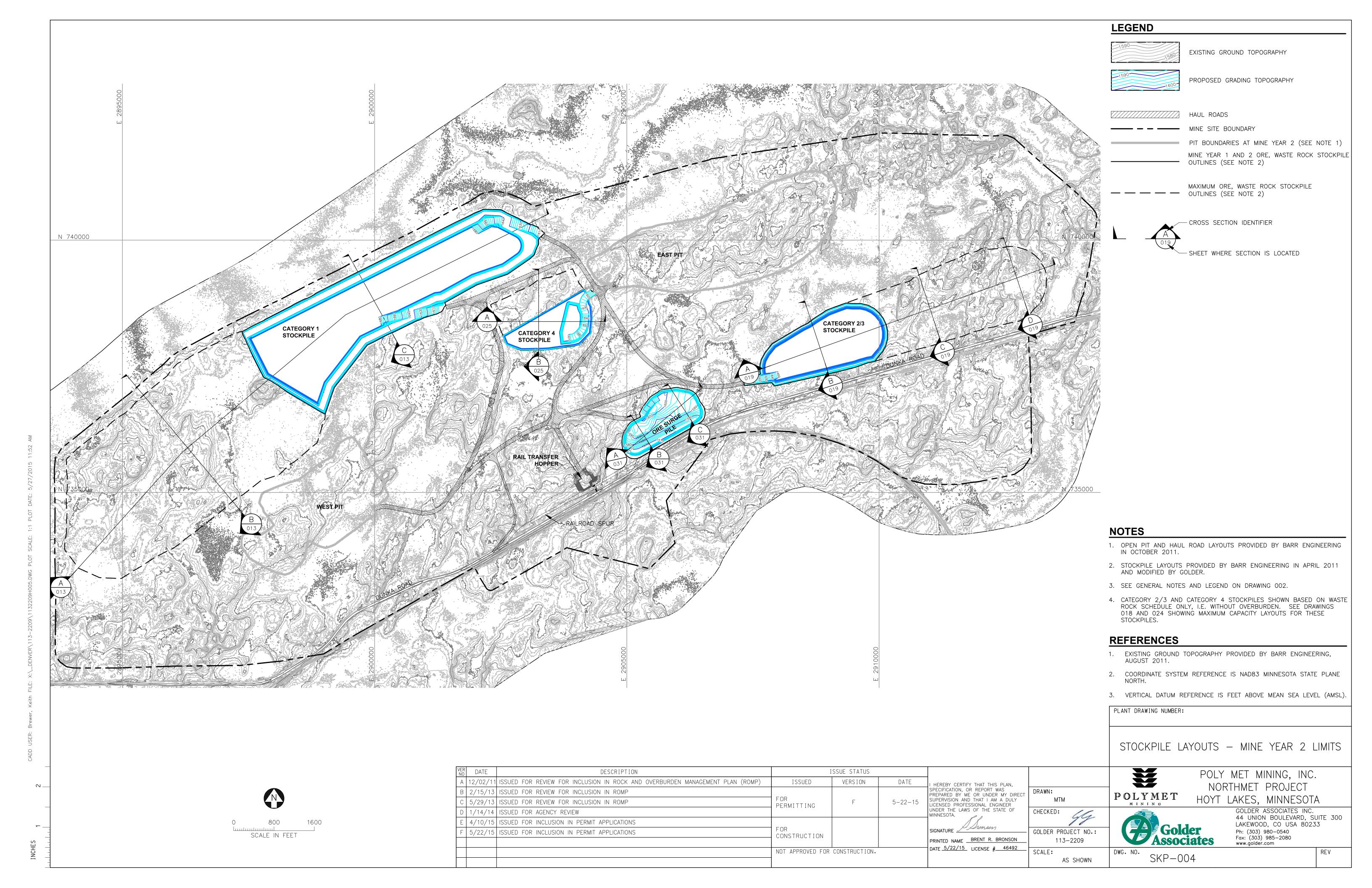
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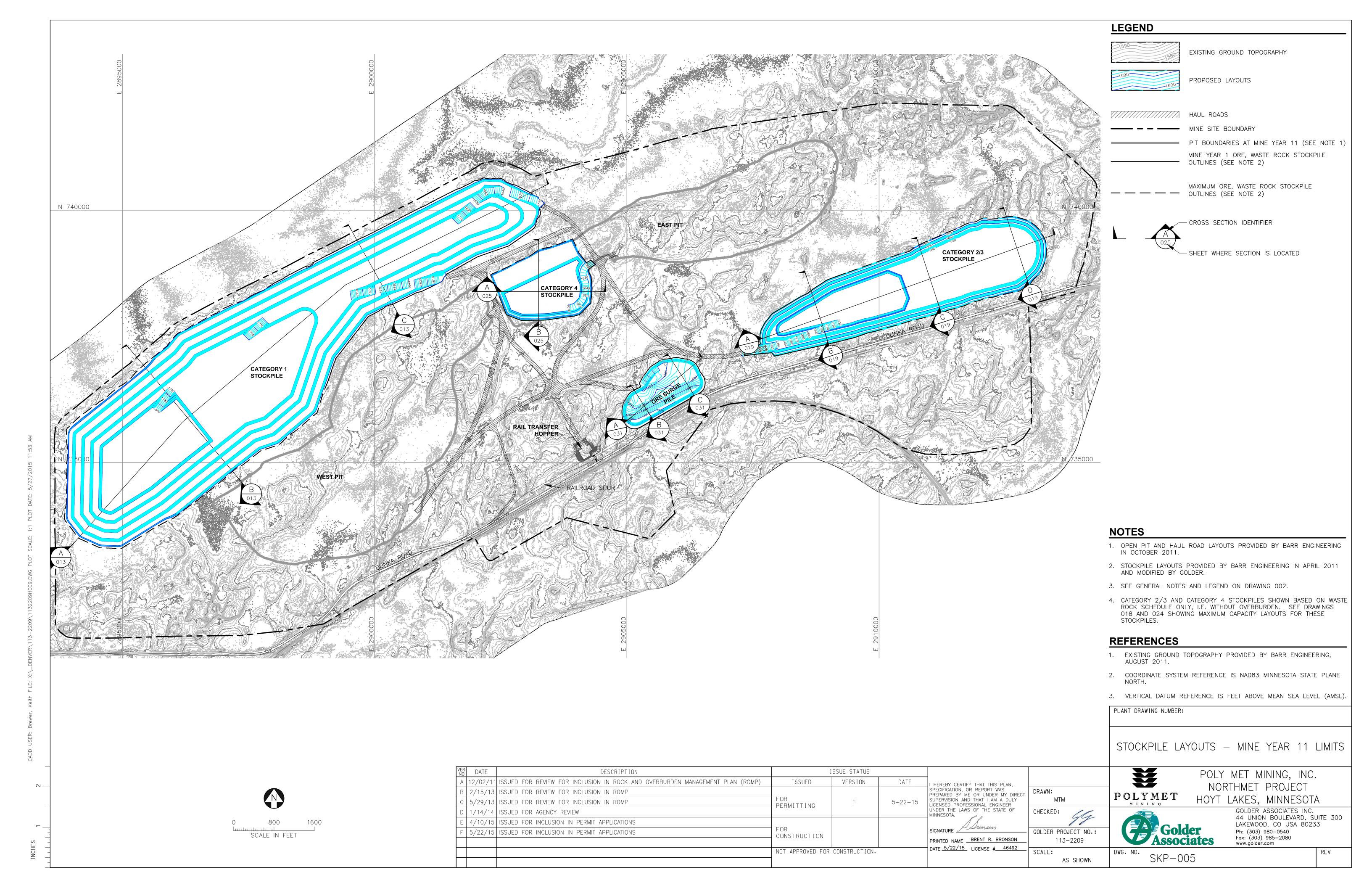
GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233 Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

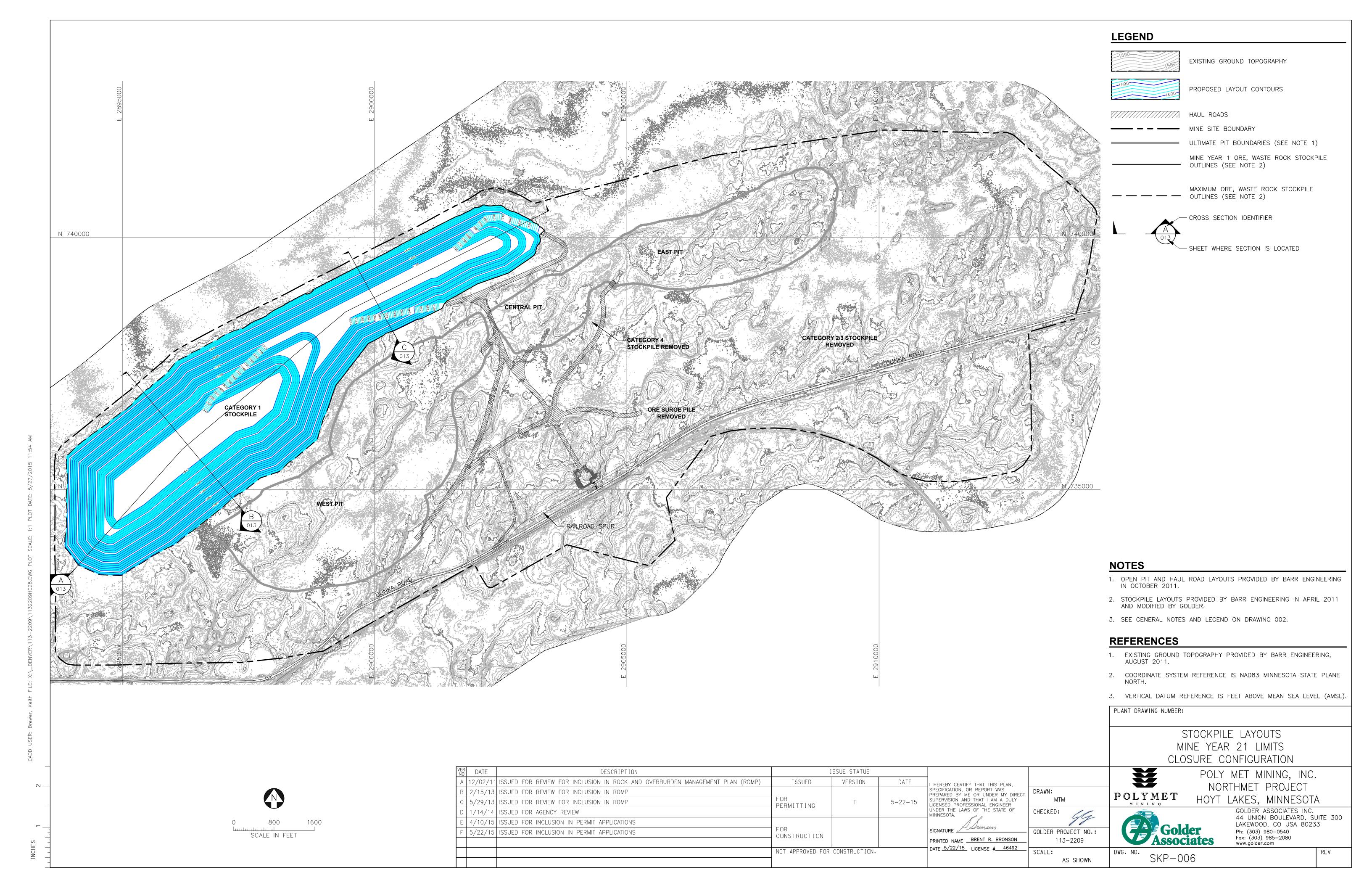
POLY MET MINING, INC.

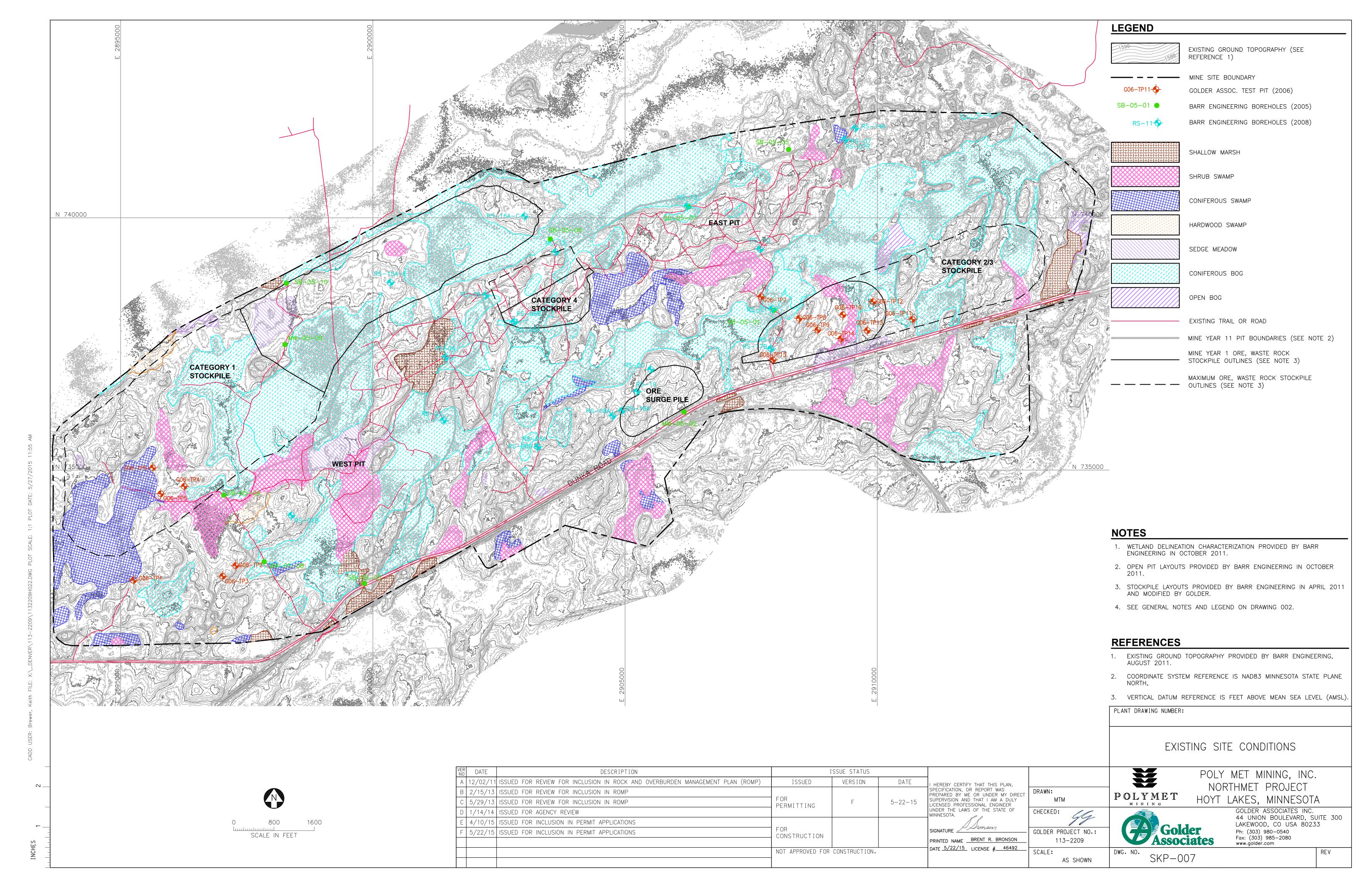
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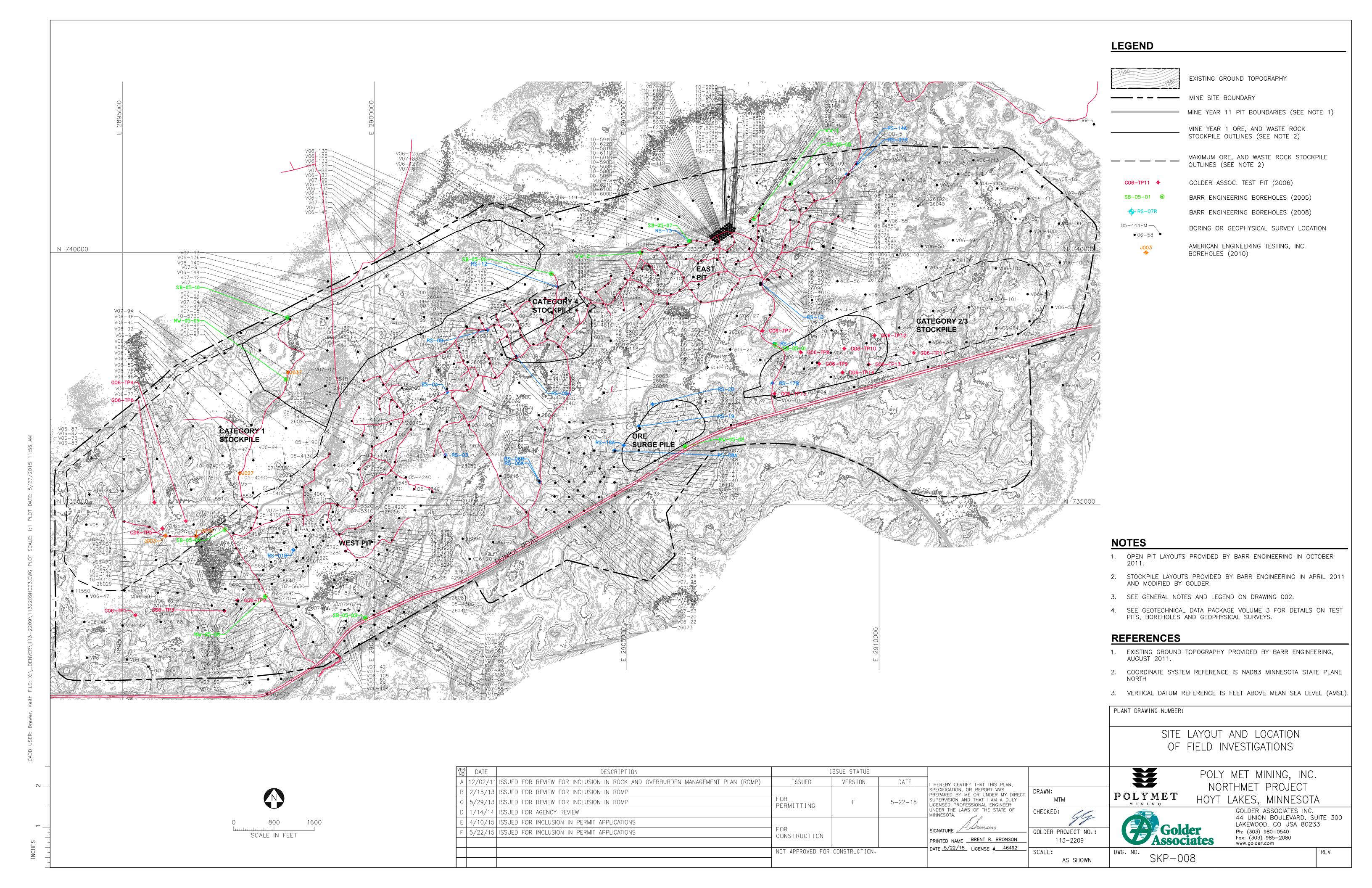


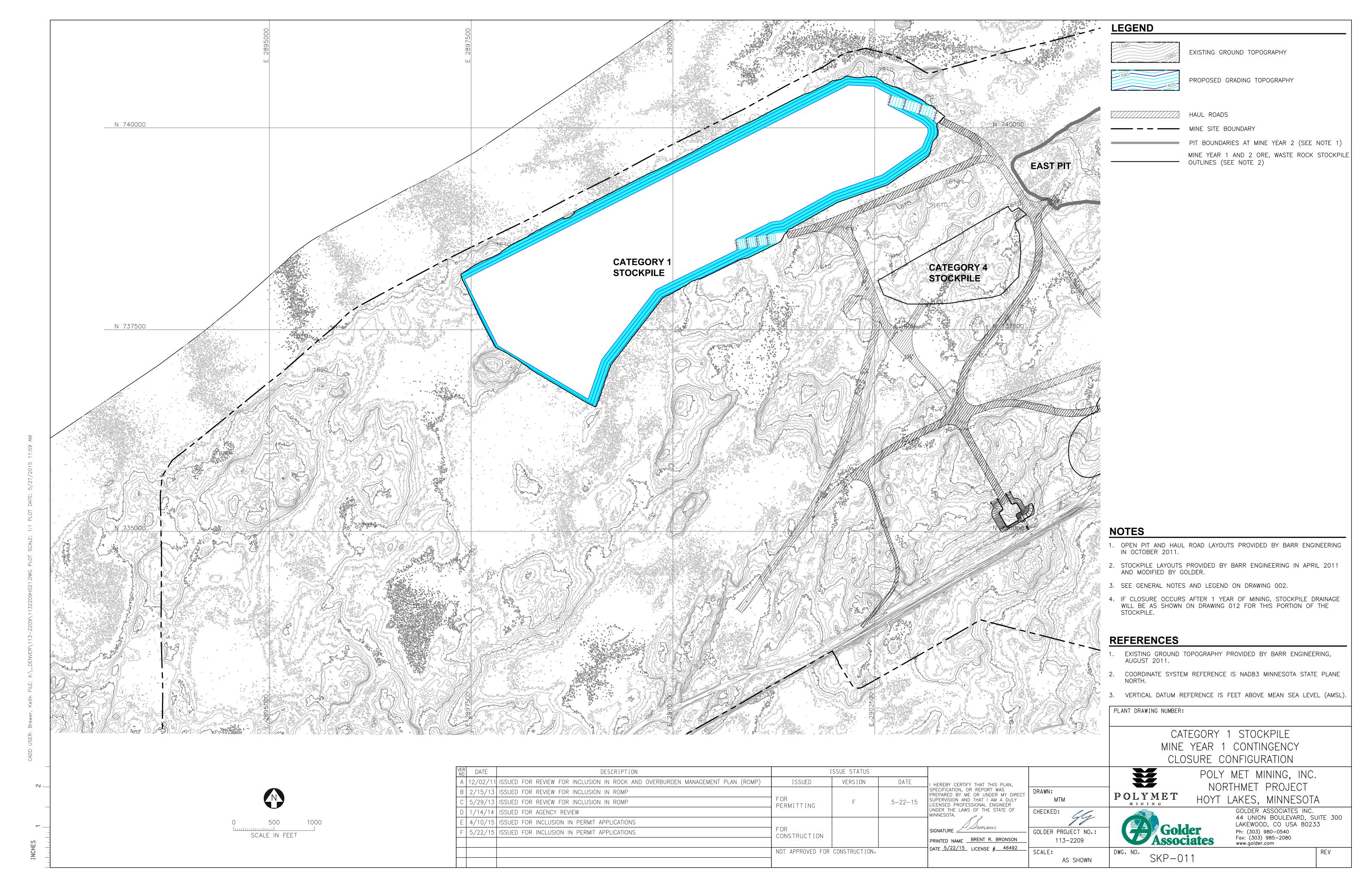


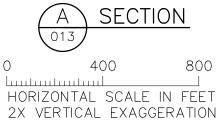


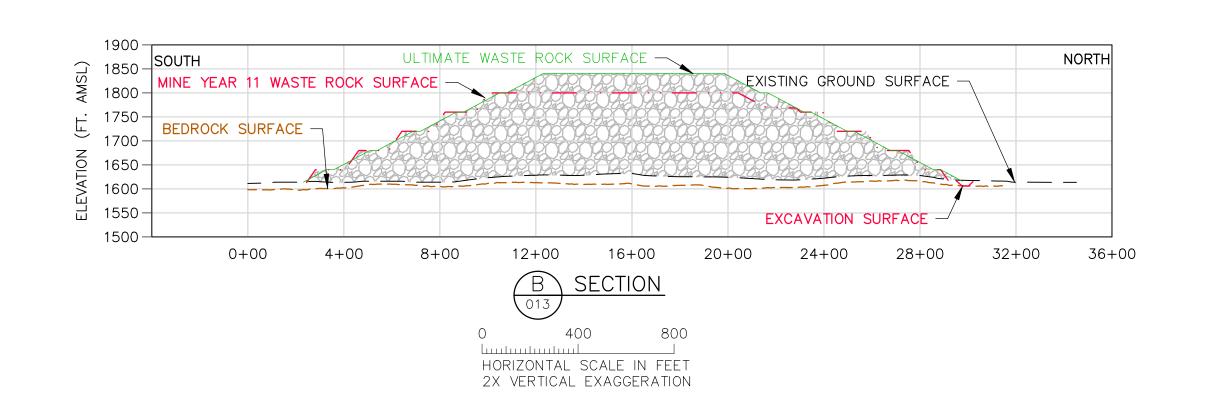


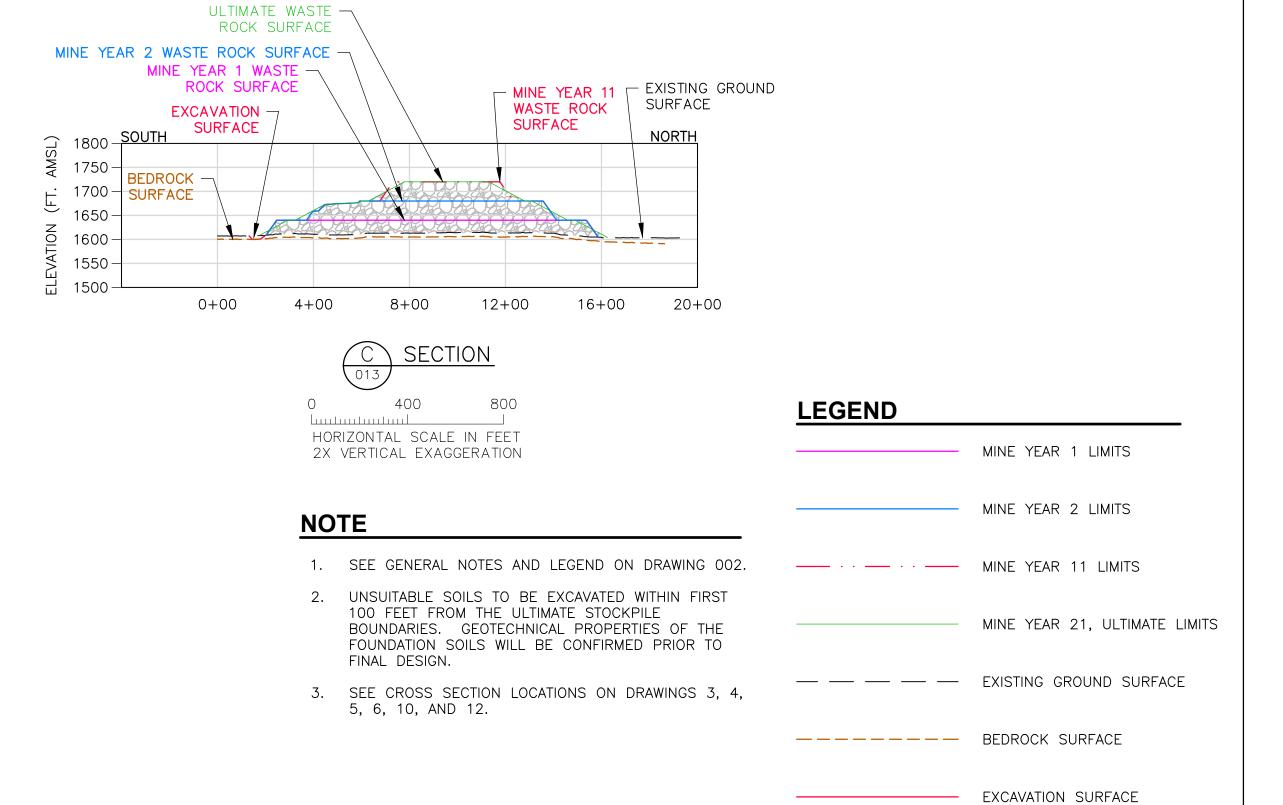












CATEGORY 1 STOCKPILE DESIGN SECTIONS POLY MET MINING, INC.

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

REV

PLANT DRAWING NUMBER:

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	3 2/15/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:	POLYMET	
	5/29/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP	T FOR PERMITTING	F	5-22-15	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	MTM	MINING	HOYT
	1/14/14	ISSUED FOR AGENCY REVIEW				UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:		
	E 4/10/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS				Dronsen	77	E A COL	1
	5/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	T FOR CONSTRUCTION			SIGNATURE 2	GOLDER PROJECT NO.:	GOL	ier
						PRINTED NAME BRENT R. BRONSON	113-2209	ASSOC ASSOC	iates
			NOT APPROVED FOR	CONSTRUCTION.		DATE <u>5/22/15</u> LICENSE # 46492	SCALE:	DWG. NO. SKP-O	1 7
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SKP-014

AS SHOWN

EXISTING GROUND TOPOGRAPHY (SEE

REFERENCE 1) PROPOSED MINE YEAR 1 GRADING TOPOGRAPHY

PROPOSED MAXIMUM FOOTPRINT GRADING TOPOGRAPHY

MINE SITE BOUNDARY

CROSS SECTION IDENTIFIER

- SHEET WHERE SECTION IS LOCATED

MINE YEAR 11 PIT BOUNDARIES (SEE NOTE 1)

MINE YEAR 1 WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

MAXIMUM WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROADS

MINE DRAINAGE SUMP/POND (SEE NOTE 3)

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE MECHANICAL INFRASTRUCTURE PERMIT SUPPORT DRAWINGS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 2/3 STOCKPILE FOUNDATION GRADING PLAN MINE YEAR 1 AND MAXIMUM

POLY MET MINING, INC. NORTHMET PROJECT

POLYMET

HOYT LAKES, MINNESOTA GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

REV

Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com Associates

SCALE IN FEET

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SUPERVISION AND THAT I AM A DULY
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UNDER THE LAWS OF THE STATE OF
MINNESOTA. ISSUED VERSION DATE B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP DRAWN: C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING D 1/14/14 ISSUED FOR AGENCY REVIEW E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS SIGNATURE Librarsen F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION PRINTED NAME BRENT R. BRONSON

NOT APPROVED FOR CONSTRUCTION.

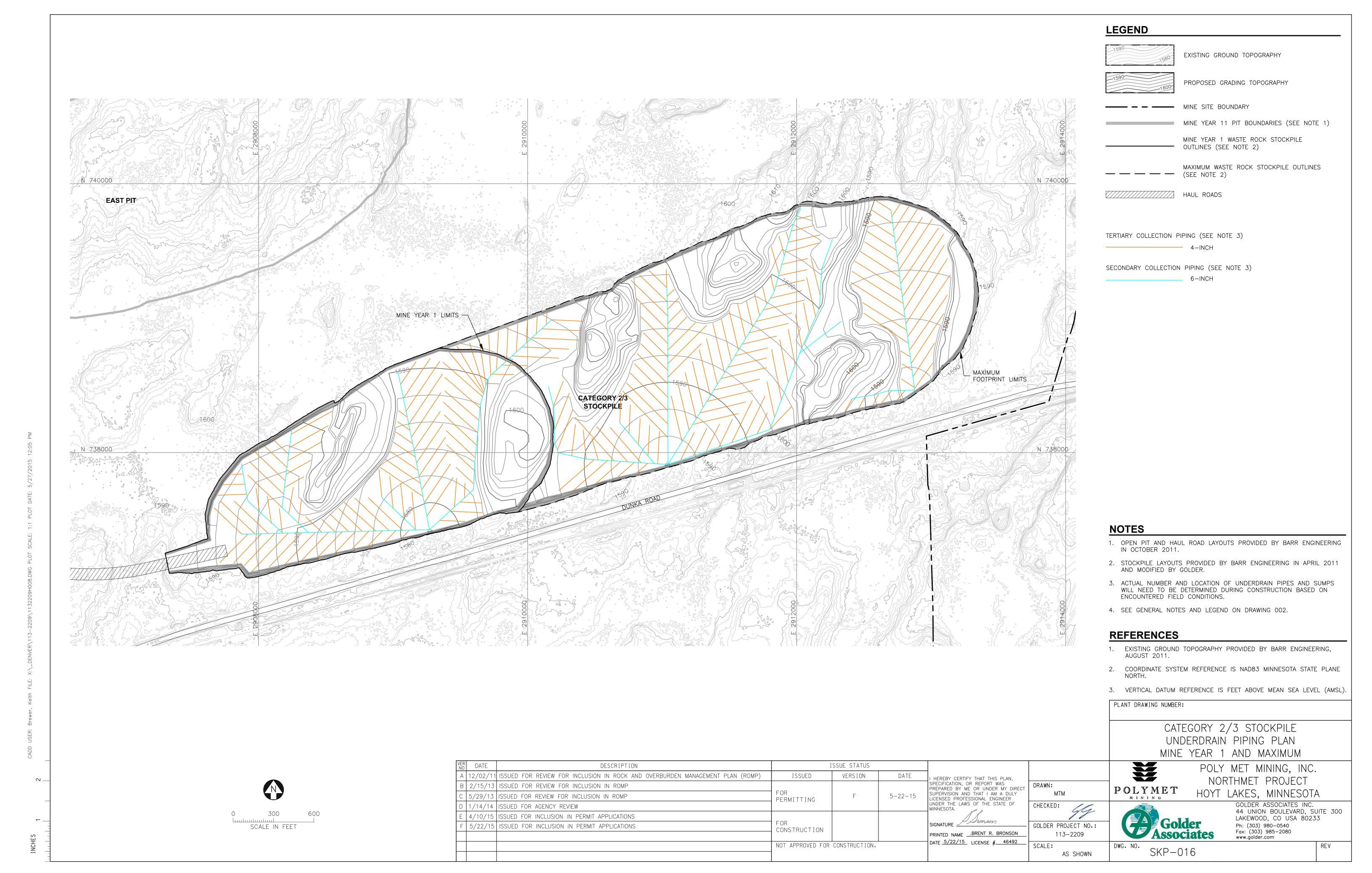
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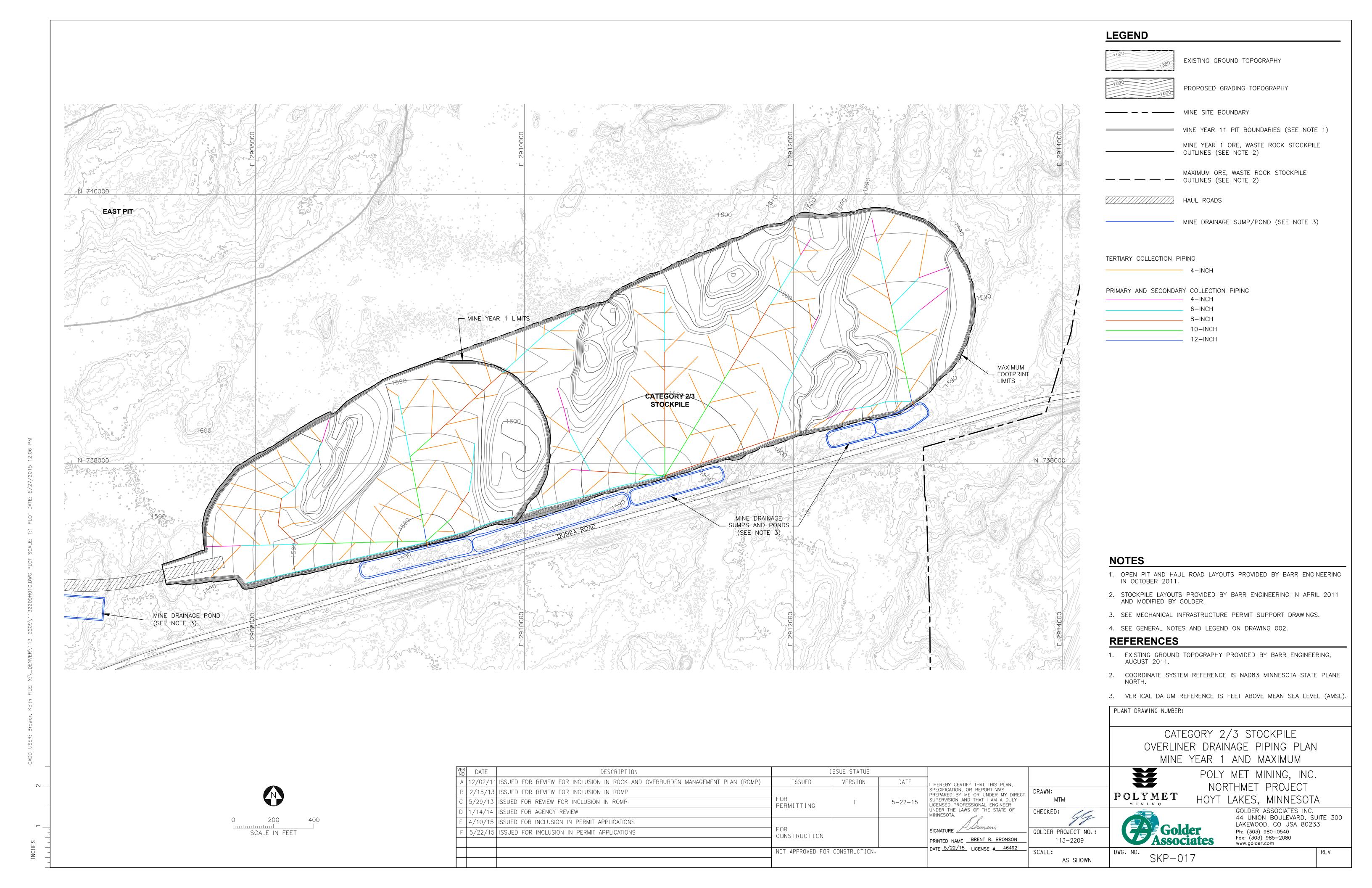
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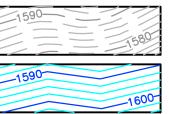
AS SHOWN

DWG. NO. SKP-015

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EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 1)

PROPOSED MAXIMUM GRADING TOPOGRAPHY

MINE SITE BOUNDARY

CROSS SECTION IDENTIFIER

SHEET WHERE SECTION IS LOCATED

MINE YEAR 1 WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

MAXIMUM ORE, WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

PROPOSED HAUL ROAD

MINE YEAR 11 PIT BOUNDARIES (SEE NOTE 1)

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 2/3 STOCKPILE MAXIMUM CAPACITY CONFIGURATION

P O L Y M E T

POLY MET MINING, INC. NORTHMET PROJECT

HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

SKP-018

SCALE IN FEET

VER DATE DESCRIPTION ISSUE STATUS A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) ISSUED **VERSION** DATE B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP C | 5/29/13 | ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING D 1/14/14 ISSUED FOR AGENCY REVIEW E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION NOT APPROVED FOR CONSTRUCTION.

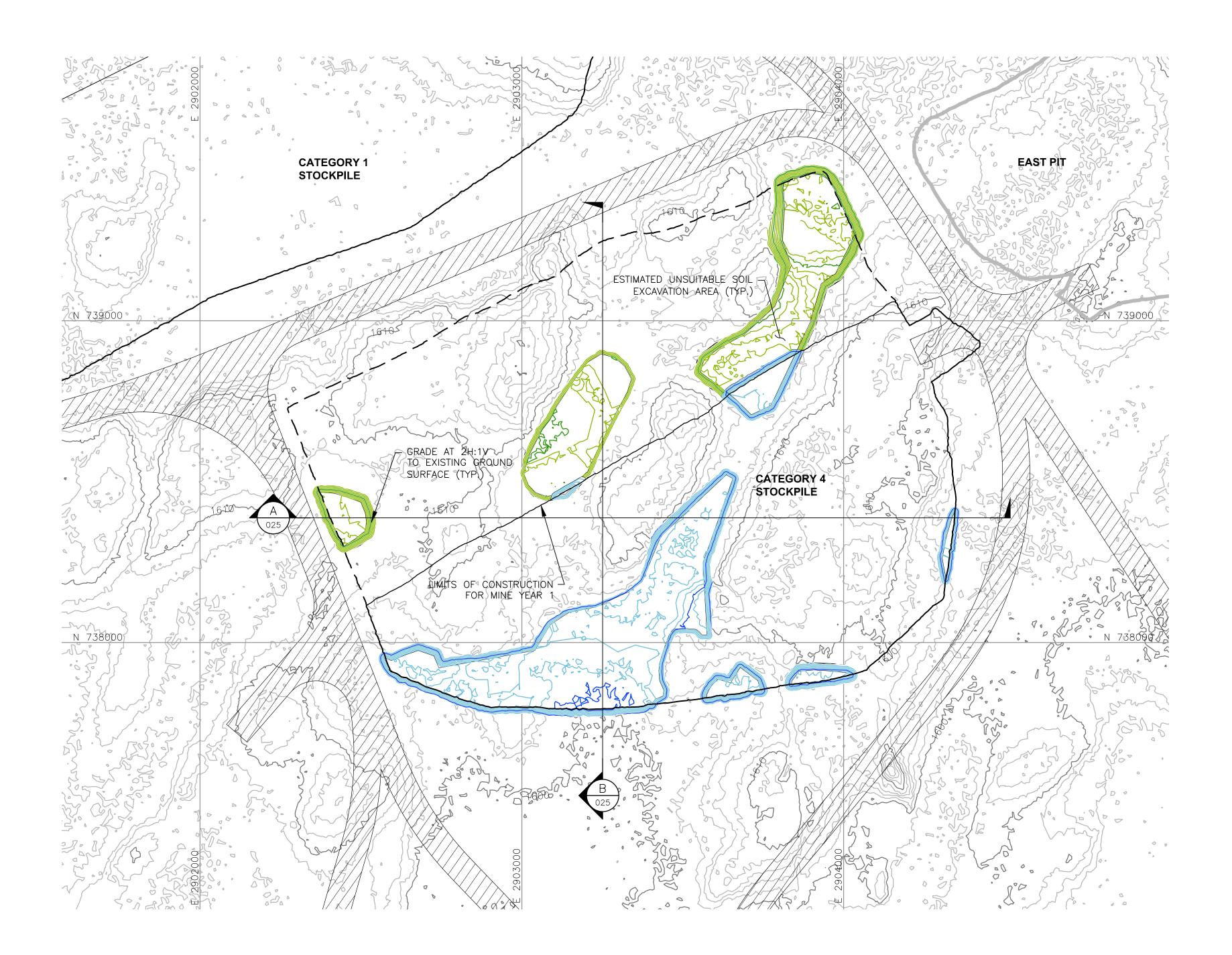
I HEREBY CERTIFY THAT THIS PLAN,
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PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY
LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF DRAWN: CHECKED: MINNESOTA. Densen SIGNATURE 🚄

GOLDER PROJECT NO.: PRINTED NAME BRENT R. BRONSON 113-2209 DATE <u>5/22/15</u> LICENSE # 46492 SCALE:

AS SHOWN

Associates DWG. NO.

Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com REV



DESCRIPTION

A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP)

VER DATE

NOTES

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE

MINE YEAR 1 WASTE ROCK STOCKPILE

MINE YEAR 2 PIT BOUNDARIES (SEE NOTE 1)

- SHEET WHERE SECTION IS LOCATED

— CROSS SECTION IDENTIFIER

MAXIMUM WASTE ROCK STOCKPILE

PROPOSED MINE YEAR 1 EXCAVATION TOPOGRAPHY

PROPOSED MAXIMUM FOOTPRINT EXCAVATION

REFERENCE 1)

TOPOGRAPHY

OUTLINES (SEE NOTE 2)

— OUTLINES (SEE NOTE 2)

- - MINE SITE BOUNDARY

HAUL ROADS

- OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

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CATEGORY 4 STOCKPILE SUBGRADE EXCAVATION PLAN

吾 $\mathbb{P} \underset{\scriptscriptstyle{M}}{\mathbb{O}} \underset{\scriptscriptstyle{K}}{\mathbb{L}} \underset{\scriptscriptstyle{N}}{\mathbb{Y}} \underset{\scriptscriptstyle{K}}{\mathbb{M}} \underset{\scriptscriptstyle{G}}{\mathbb{E}} \mathbb{T}$

DRAWN:

CHECKED:

SCALE:

MTM

GOLDER PROJECT NO.:

113-2209

AS SHOWN

PLANT DRAWING NUMBER:

POLY MET MINING, INC. NORTHMET PROJECT

HOYT LAKES, MINNESOTA

DWG. NO.

SKP-020

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233 Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

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UNDER THE LAWS OF THE STATE OF
MINNESOTA. B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING D 1/14/14 ISSUED FOR AGENCY REVIEW E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS SIGNATURE Librarsen F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE # 46492 NOT APPROVED FOR CONSTRUCTION.

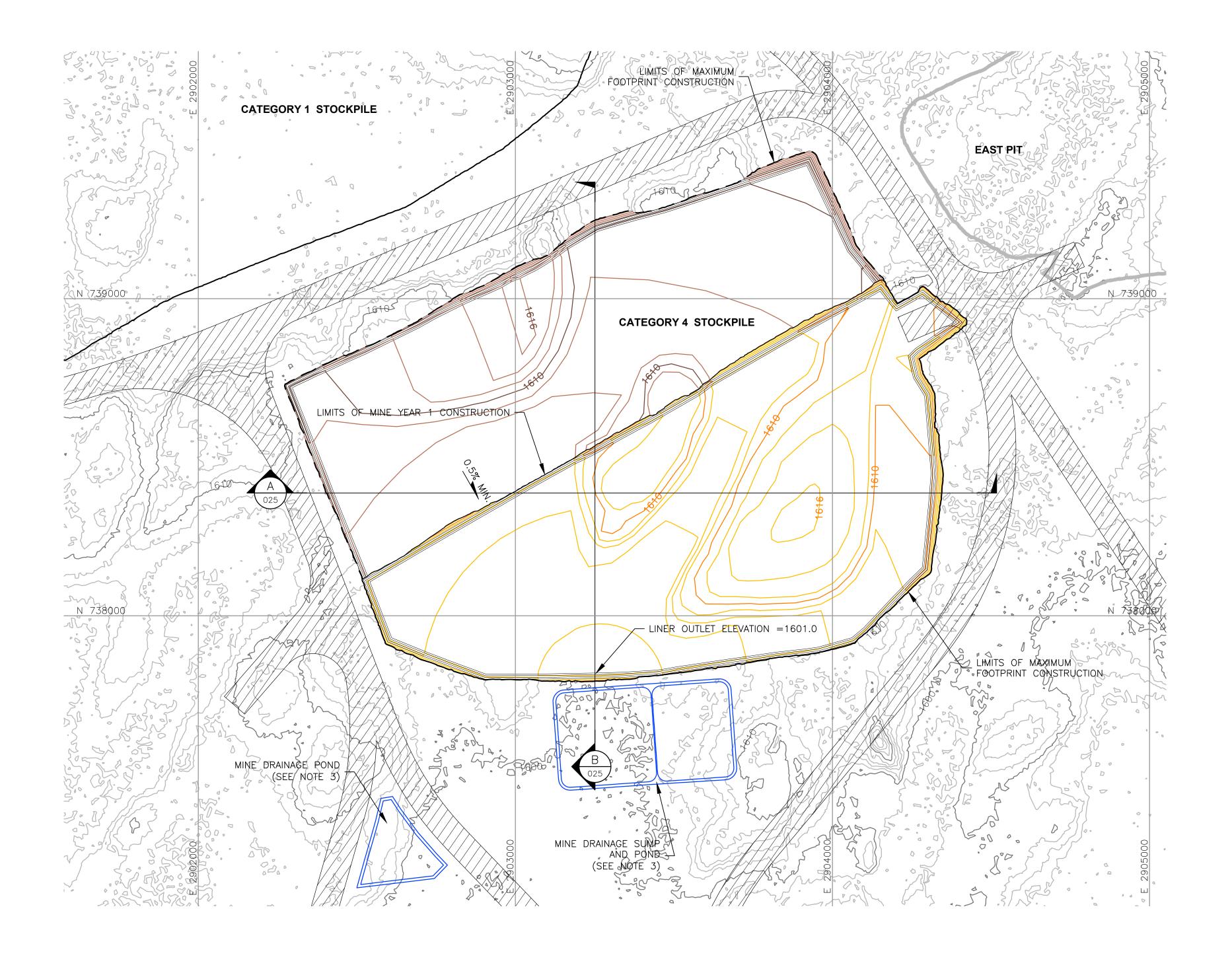
ISSUE STATUS

VERSION

DATE

ISSUED

SCALE IN FEET



DESCRIPTION

A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP)

B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP

C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP

E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

D 1/14/14 ISSUED FOR AGENCY REVIEW

VER DATE

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE

REFERENCE 1)

PROPOSED MINE YEAR 1 GRADING TOPOGRAPHY

PROPOSED MAXIMUM FOOTPRINT GRADING

- MINE SITE BOUNDARY

- CROSS SECTION IDENTIFIER

TOPOGRAPHY

- SHEET WHERE SECTION IS LOCATED

SLOPE

MINE YEAR 1 WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

MAXIMUM WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROAD

MINE YEAR 2 PIT BOUNDARIES (SEE NOTE 1)

MINE DRAINAGE SUMP/POND (SEE NOTE 3)

NOTES

OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.

2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011

- AND MODIFIED BY GOLDER.
- 3. SEE MECHANICAL INFRASTRUCTURE PERMIT SUPPORT DRAWINGS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 4 STOCKPILE FOUNDATION GRADING PLAN MINE YEAR 1 AND MAXIMUM

POLY MET MINING, INC. NORTHMET PROJECT

POLYMET

吾

HOYT LAKES, MINNESOTA GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

REV

Ph: (303) 980-0540 Fax: (303) 985-2080 Associates www.golder.com

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UNDER THE LAWS OF THE STATE OF
MINNESOTA. CHECKED: SIGNATURE Librarsen GOLDER PROJECT NO.: PRINTED NAME BRENT R. BRONSON 113-2209 DATE <u>5/22/15</u> LICENSE # 46492 SCALE:

DRAWN:

MTM

ISSUE STATUS

VERSION

DATE

ISSUED

PERMITTING

CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.

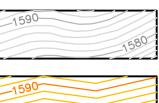
AS SHOWN

DWG. NO.

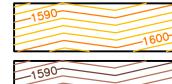
SKP-021

VER DATE

LEGEND



EXISTING GROUND TOPOGRAPHY



PROPOSED MINE YEAR 1 GRADING TOPOGRAPHY

PROPOSED MAXIMUM FOOTPRINT GRADING TOPOGRAPHY

----- MINE SITE BOUNDARY

MINE YEAR 2 PIT BOUNDARIES (SEE NOTE 1)

MINE YEAR 1 WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

MAXIMUM WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROADS

TERTIARY COLLECTION PIPING (SEE NOTE 3)

4-INCH

SECONDARY COLLECTION PIPING (SEE NOTE 3)

6-INCH

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. ACTUAL NUMBER AND LOCATION OF UNDERDRAIN PIPES AND SUMPS WILL NEED TO BE DETERMINED DURING CONSTRUCTION BASED ON ENCOUNTERED FIELD CONDITIONS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

MTM

113-2209

AS SHOWN

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 4 STOCKPILE UNDERDRAIN PIPING PLAN

MINE YEAR 1 AND MAXIMUM POLY MET MINING, INC.

¥ NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233 Ph: (303) 980-0540 Fax: (303) 985-2080

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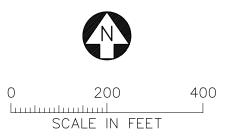
SCALE IN FEET

A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) I HEREBY CERTIFY THAT THIS PLAN,
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SUPERVISION AND THAT I AM A DULY
LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF
MINNESOTA. DATE ISSUED VERSION B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP DRAWN: C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING D 1/14/14 ISSUED FOR AGENCY REVIEW CHECKED: E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS Klonson SIGNATURE 🚄 GOLDER PROJECT NO.: F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS CONSTRUCTION PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE # 46492 NOT APPROVED FOR CONSTRUCTION. SCALE:

DESCRIPTION

ISSUE STATUS

EAST PIT CATEGORY 4 STOCKPILE MINE DRAINAGE POND (SEE NOTE 3)



VER NO	DATE	DESCRIPTION	ISSUE STATUS				
		ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP)	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,	
В	2/15/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	
С	5/29/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP	FOR PERMITTING	F		SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	
D	1/14/14	ISSUED FOR AGENCY REVIEW	- I LIKWII I I IIVO			UNDER THE LAWS OF THE STATE OF MINNESOTA.	
Ε	4/10/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS				Densen	
F	5/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	FOR CONSTRUCTION			SIGNATURE SIGNATURE	
			CONSTRUCTION			PRINTED NAME BRENT R. BRONSON	
			NOT APPROVED FOR		•	DATE <u>5/22/15</u> LICENSE # 46492	
			- CONSTRUCTION.				

LEGEND

1590	EXISTING GROUND TOPOGRAPHY
1590	PROPOSED MINE YEAR 1 GRADING TOPOGRAP
	PROPOSED MAXIMUM FOOTPRINT GRADING TOPOGRAPHY
	MINE SITE BOUNDARY
	MINE YEAR 2 PIT BOUNDARIES (SEE NOTE 1)
	SLOPE
	MINE YEAR 1 WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)
	MAXIMUM WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)
	HAUL ROADS
	MINE DRAINAGE SUMP/POND (SEE NOTE 3)
MINE YEAR 1 — TERTIAI	RY COLLECTION PIPING - 4-INCH
MINE YEAR 1 — PRIMAR	AND SECONDARY COLLECTION PIPING 4-INCH 6-INCH 8-INCH 10-INCH 12-INCH

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE MECHANICAL INFRASTRUCTURE PERMIT SUPPORT DRAWINGS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE NORTH.
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 4 STOCKPILE OVERLINER DRAINAGE PIPING PLAN MINE YEAR 1 AND MAXIMUM



DRAWN:

CHECKED:

SCALE:

GOLDER PROJECT NO.:

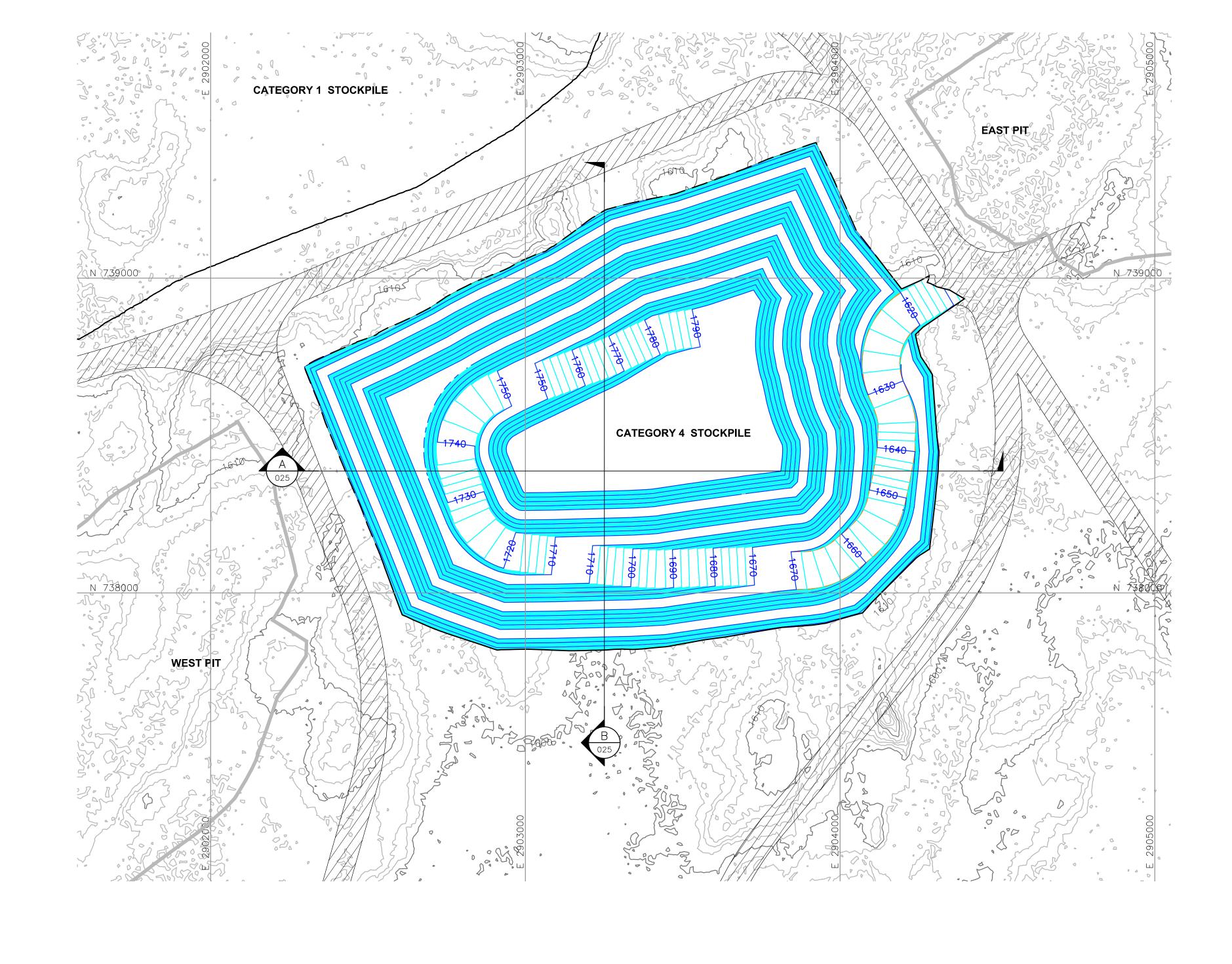
113-2209

AS SHOWN

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC.
44 UNION BOULEVARD, SUITE 300
LAKEWOOD, CO USA 80233
Ph: (303) 980-0540
Fax: (303) 985-2080
www.golder.com

SKP-023



SCALE IN FEET

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LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF MINNESOTA. Dronson SIGNATURE ___

CHECKED: PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE # 46492 SCALE:

DRAWN: MTM GOLDER PROJECT NO.: 113-2209

AS SHOWN

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA



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SKP-024

NOTES

LEGEND

EXISTING GROUND TOPOGRAPHY

- CROSS SECTION IDENTIFIER

MINE YEAR 1 WASTE ROCK STOCKPILE LIMIT (SEE NOTE 1)

- SHEET WHERE SECTION IS LOCATED

- MAXIMUM WASTE ROCK STOCKPILE LIMIT

MINE YEAR 11 PIT BOUNDARIES (SEE NOTE 1)

PROPOSED MAXIMUM GRADING TOPOGRAPHY

(SEE REFERENCE 1)

MINE SITE BOUNDARY

PROPOSED HAUL ROAD

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

CATEGORY 4 STOCKPILE STOCKPILE MAXIMUM CAPACITY CONFIGURATION

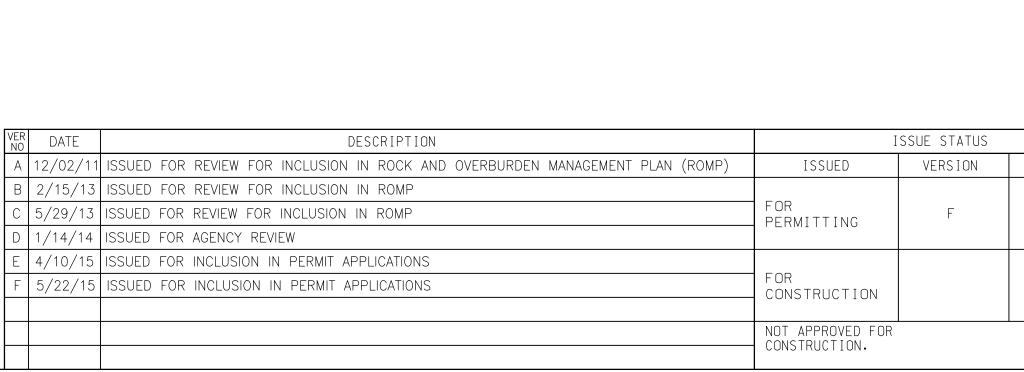
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AS SHOWN

1850 WEST



SCALE IN FEET



LIMITS OF LINER CONSTRUCTION

ORE SURGE PILE

RAILROAD SPUR

BEDROCK EXCAVATION AREA -

LIMITS OF EXCAVATION

LIMITS OF BEDROCK

DATE I HEREBY CERTIFY THAT THIS PLAN,
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LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF 5-22-15 MINNESOTA. SIGNATURE & Shonson PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE #<u>46492</u>

DRAWN: MTM CHECKED: GOLDER PROJECT NO.: 113-2209

SCALE:

NORTHMET PROJECT HOYT LAKES, MINNESOTA GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

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CATEGORY 2/3

STOCKPILE BOUNDARY

NOTES

LEGEND

EXISTING GROUND TOPOGRAPHY (SEE

MINE YEAR 1 ORE STOCKPILE

- CROSS SECTION IDENTIFIER

SHEET WHERE SECTION IS LOCATED

OUTLINES (SEE NOTE 2)

PROPOSED MINE YEAR 1 EXCAVATION TOPOGRAPHY

REFERENCE 1)

-- MINE SITE BOUNDARY

HAUL ROADS

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

ORE SURGE PILE SUBGRADE EXCAVATION PLAN

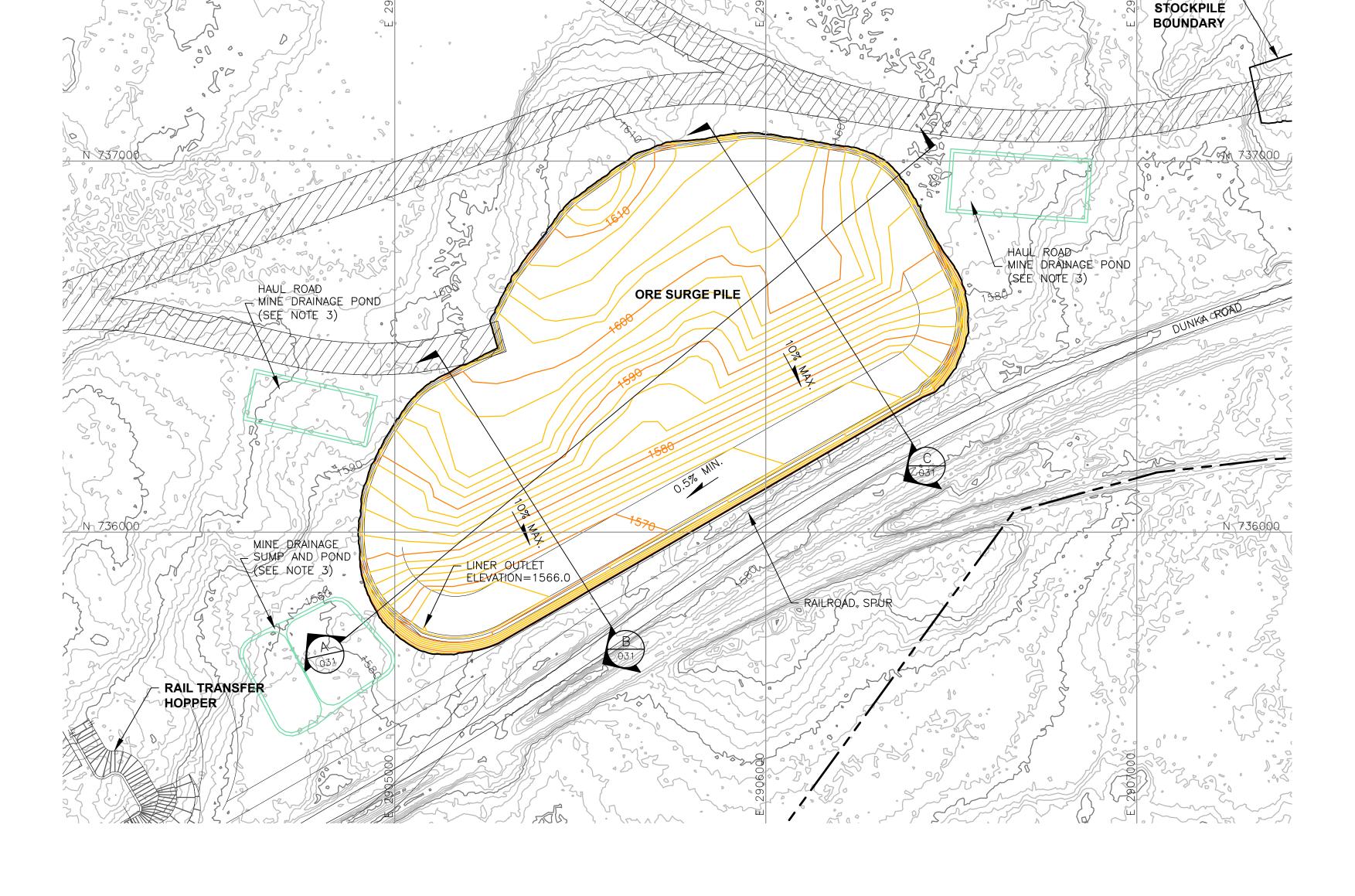
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POLY MET MINING, INC.

SKP-026 AS SHOWN

RAIL TRANSFER

HOPPER



EXISTING GROUND TOPOGRAPHY (SEE REFERENCE 1)

PROPOSED MINE YEAR 1 GRADING TOPOGRAPHY

MINE SITE BOUNDARY



- CROSS SECTION IDENTIFIER

- SHEET WHERE SECTION IS LOCATED

SLOPE

MINE YEAR 1 ORE, WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROADS

MINE DRAINAGE SUMP/POND (SEE NOTE 3)

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE MECHANICAL INFRASTRUCTURE PERMIT SUPPORT DRAWINGS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS MINNESOTA STATE PLANE.
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

ORE SURGE PILE FOUNDATION GRADING PLAN



POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

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Fax: (303) 985-2080 www.golder.com

SCALE IN FEET

DESCRIPTION ISSUE STATUS A | 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) ISSUED VERSION DATE I HEREBY CERTIFY THAT THIS PLAN,
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CATEGORY 2/3 -

SIGNATURE Monson PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE # 46492

GOLDER PROJECT NO.: 113-2209 SCALE:

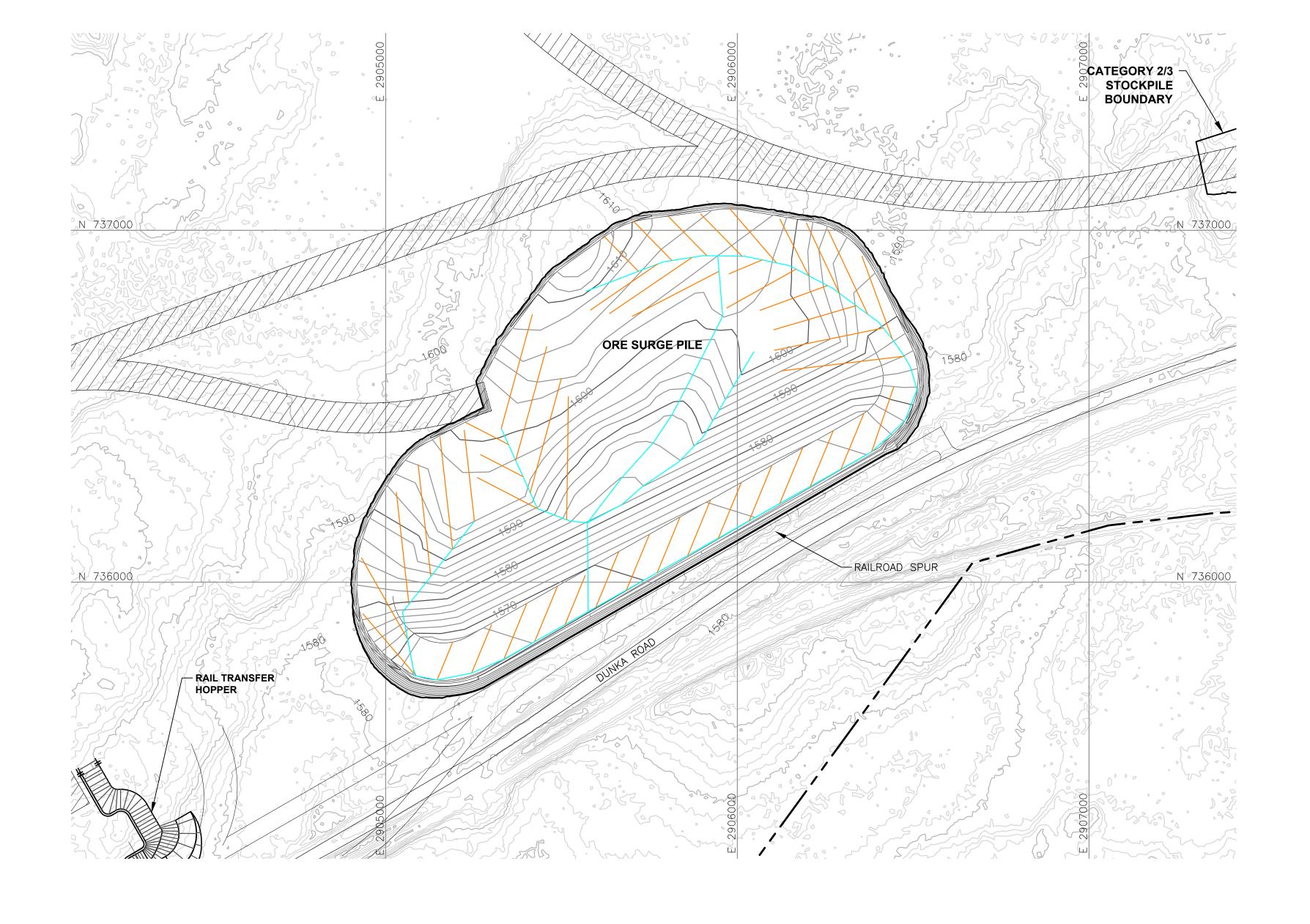
MTM

DRAWN:

CHECKED:

DWG. NO. AS SHOWN

SKP-027



EXISTING GROUND TOPOGRAPHY



PROPOSED GRADING TOPOGRAPHY

- MINE SITE BOUNDARY

MINE YEAR 1 ORE, WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROADS

TERTIARY COLLECTION PIPING (SEE NOTE 3)

4-INCH

SECONDARY COLLECTION PIPING (SEE NOTE 3) 6-INCH

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. ACTUAL NUMBER OF UNDERDRAIN PIPES AND SUMPS WILL NEED TO BE DETERMINED DURING CONSTRUCTION BASED ON ENCOUNTERED FIELD
- 2. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

PLANT DRAWING NUMBER:

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

ORE SURGE PILE UNDERDRAIN PIPING PLAN

POLY MET MINING, INC.



MTM

GOLDER PROJECT NO.:

113-2209

AS SHOWN

CHECKED:

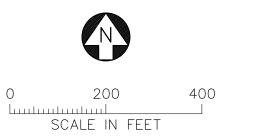
SCALE:

NORTHMET PROJECT HOYT LAKES, MINNESOTA

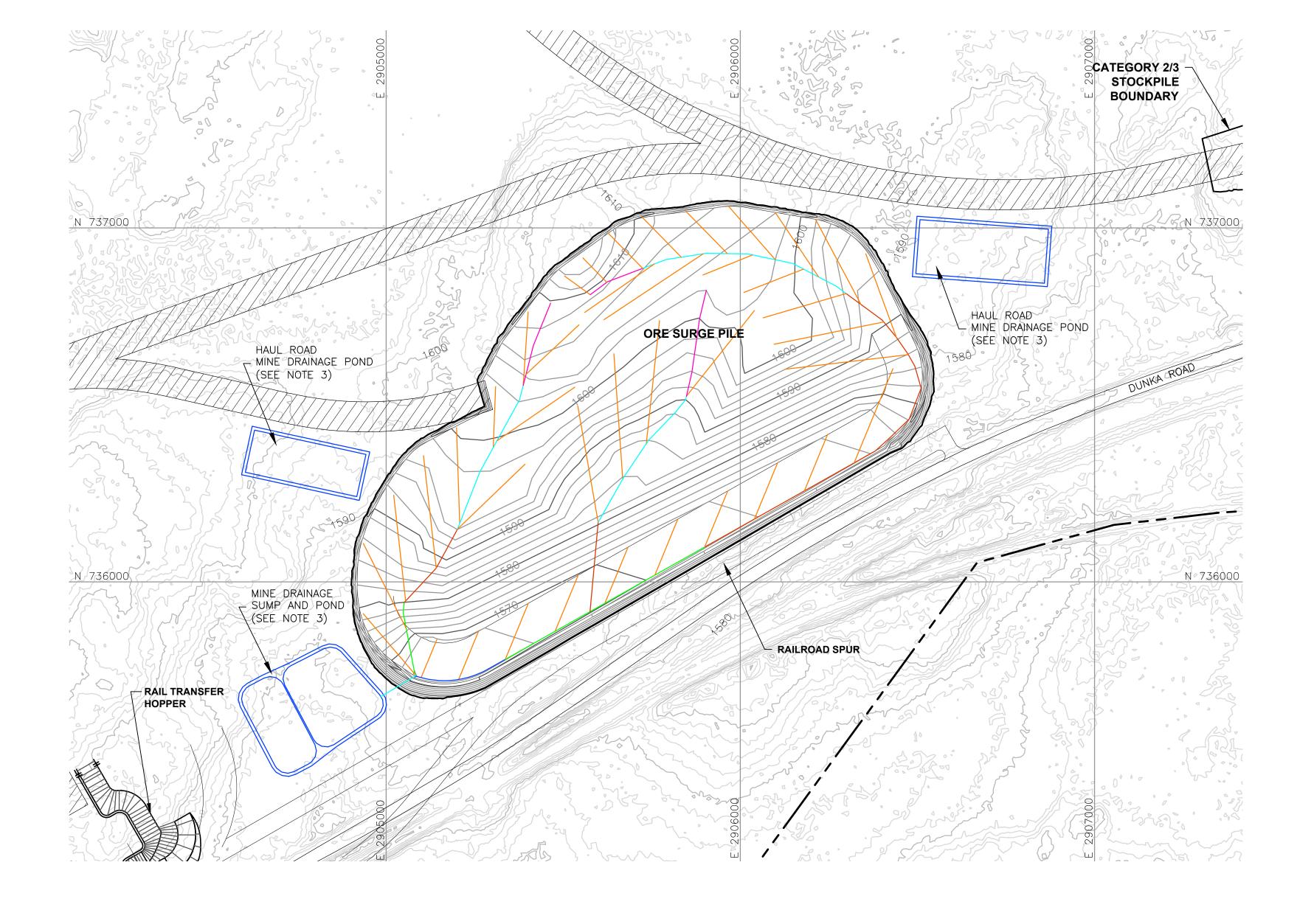
GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

DWG. NO. SKP-028

Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com REV



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EXISTING GROUND TOPOGRAPHY

PROPOSED GRADING TOPOGRAPHY

- MINE SITE BOUNDARY

MINE YEAR 1 ORE, WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

HAUL ROADS

MINE DRAINAGE SUMP/POND (SEE NOTE 3)

MINE YEAR 1 - TERTIARY COLLECTION PIPING

4-INCH

MINE YEAR 1 - PRIMARY AND SECONDARY COLLECTION PIPING

- 4-INCH 6-INCH ____ 8-INCH

— 10−INCH ___ 12-INCH

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE MECHANICAL INFRASTRUCTURE PERMIT SUPPORT DRAWINGS.
- 4. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

REFERENCES

PLANT DRAWING NUMBER:

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

ORE SURGE PILE

OVERLINER DRAINAGE PIPING PLAN

ISSUE STATUS VER DATE DESCRIPTION A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) ISSUED VERSION B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP FOR C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP PERMITTING D 1/14/14 ISSUED FOR AGENCY REVIEW E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

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UNDER THE LAWS OF THE STATE OF
MINNESOTA. MTM CHECKED: SIGNATURE Manson GOLDER PROJECT NO.: PRINTED NAME BRENT R. BRONSON

DATE <u>5/22/15</u> LICENSE # 46492

DRAWN:

SCALE:

DATE

CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.

113-2209

AS SHOWN

吾 POLY MET MINING, INC. NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233 Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

REV

Associates DWG. NO. SKP-029

SCALE IN FEET

DESCRIPTION

A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP)

B 2/15/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP

C 5/29/13 ISSUED FOR REVIEW FOR INCLUSION IN ROMP

E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

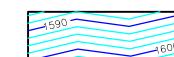
F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

D 1/14/14 ISSUED FOR AGENCY REVIEW

VER DATE

LEGEND

EXISTING GROUND TOPOGRAPHY



PROPOSED STOCKPILE LAYOUTS

HAUL ROADS

---- MINE SITE BOUNDARY

MINE YEAR 1 PIT BOUNDARY (SEE NOTE 1) MINE YEAR 1 ORE, WASTE ROCK STOCKPILE OUTLINES (SEE NOTE 2)

MAXIMUM ORE, WASTE ROCK STOCKPILE — — OUTLINES (SEE NOTE 2)



- CROSS SECTION IDENTIFIER

- SHEET WHERE SECTION IS LOCATED

NOTES

- 1. OPEN PIT AND HAUL ROAD LAYOUTS PROVIDED BY BARR ENGINEERING IN OCTOBER 2011.
- 2. STOCKPILE LAYOUTS PROVIDED BY BARR ENGINEERING IN APRIL 2011 AND MODIFIED BY GOLDER.
- 3. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

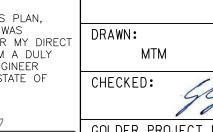
REFERENCES

- 1. EXISTING GROUND TOPOGRAPHY PROVIDED BY BARR ENGINEERING, AUGUST 2011.
- 2. COORDINATE SYSTEM REFERENCE IS NAD83 MINNESOTA STATE PLANE
- 3. VERTICAL DATUM REFERENCE IS FEET ABOVE MEAN SEA LEVEL (AMSL).

PLANT DRAWING NUMBER:

ORE SURGE PILE

TYPICAL CONFIGURATION



A POLY MET MINING, INC. NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

Associates DWG. NO. SKP-030

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PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY
LICENSED PROFESSIONAL ENGINEER
UNDER THE LAWS OF THE STATE OF
MINNESOTA. SIGNATURE Manson PRINTED NAME BRENT R. BRONSON DATE <u>5/22/15</u> LICENSE # 46492 SCALE: AS SHOWN

ISSUE STATUS

VERSION

DATE

ISSUED

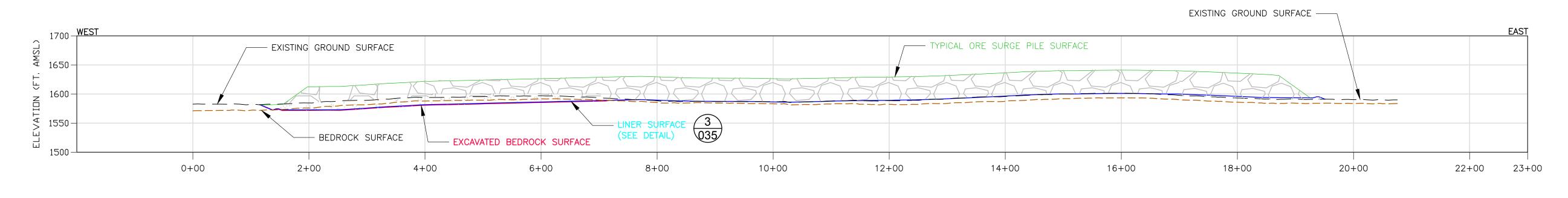
PERMITTING

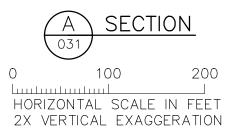
CONSTRUCTION

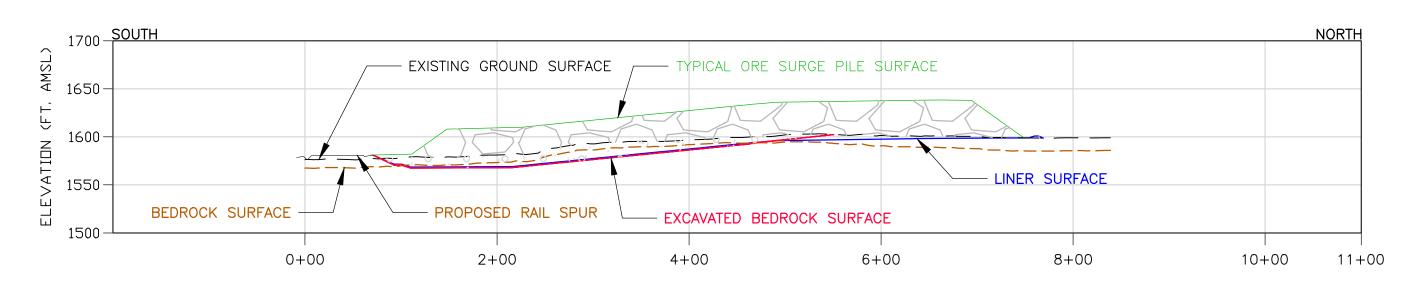
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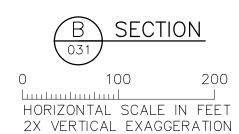
GOLDER PROJECT NO.: 113-2209

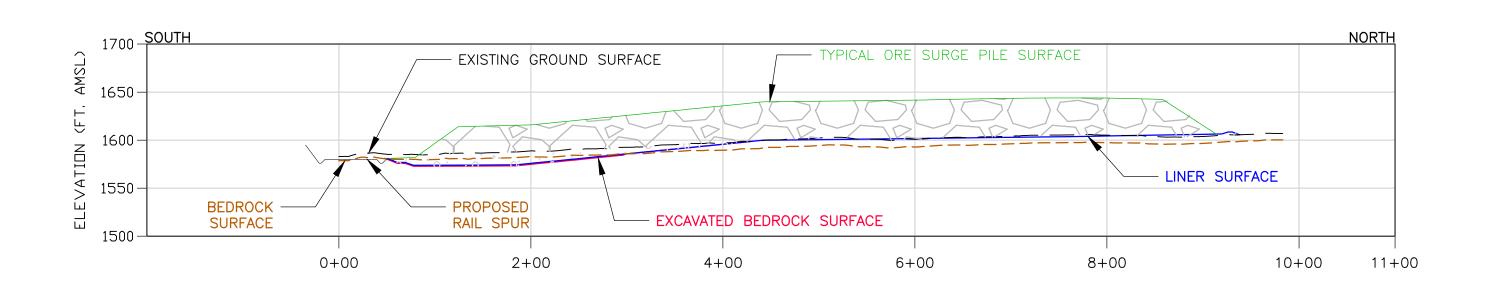
Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

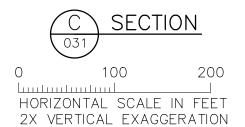












VER NO	DATE	DESCRIPTION	ISSUE STATUS				
А	1	ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP)	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,	
В	2/15/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:
С	5/29/13	ISSUED FOR REVIEW FOR INCLUSION IN ROMP	FOR PERMITTING	F	5-22-15	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. SIGNATURE	MTM
D	1/14/14	ISSUED FOR AGENCY REVIEW					CHECKED:
Ε	4/10/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS					77
F	5/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	FOR CONSTRUCTION				GOLDER PROJECT NO.:
			001131110011011			PRINTED NAME BRENT R. BRONSON	113–2209
			NOT APPROVED FOR CONSTRUCTION.			DATE <u>5/22/15</u> LICENSE # 46492	SCALE:
			1				AS SHOWN

LEGEND ORE LIMITS AT TYPICAL CAPACITY LINER SURFACE — — — EXISTING GROUND SURFACE OVERBURDEN SOIL AND BEDROCK EXCAVATION SURFACE ---- BEDROCK SURFACE

NOTES

DWG. NO.

SKP-031

PLANT DRAWING NUMBER:

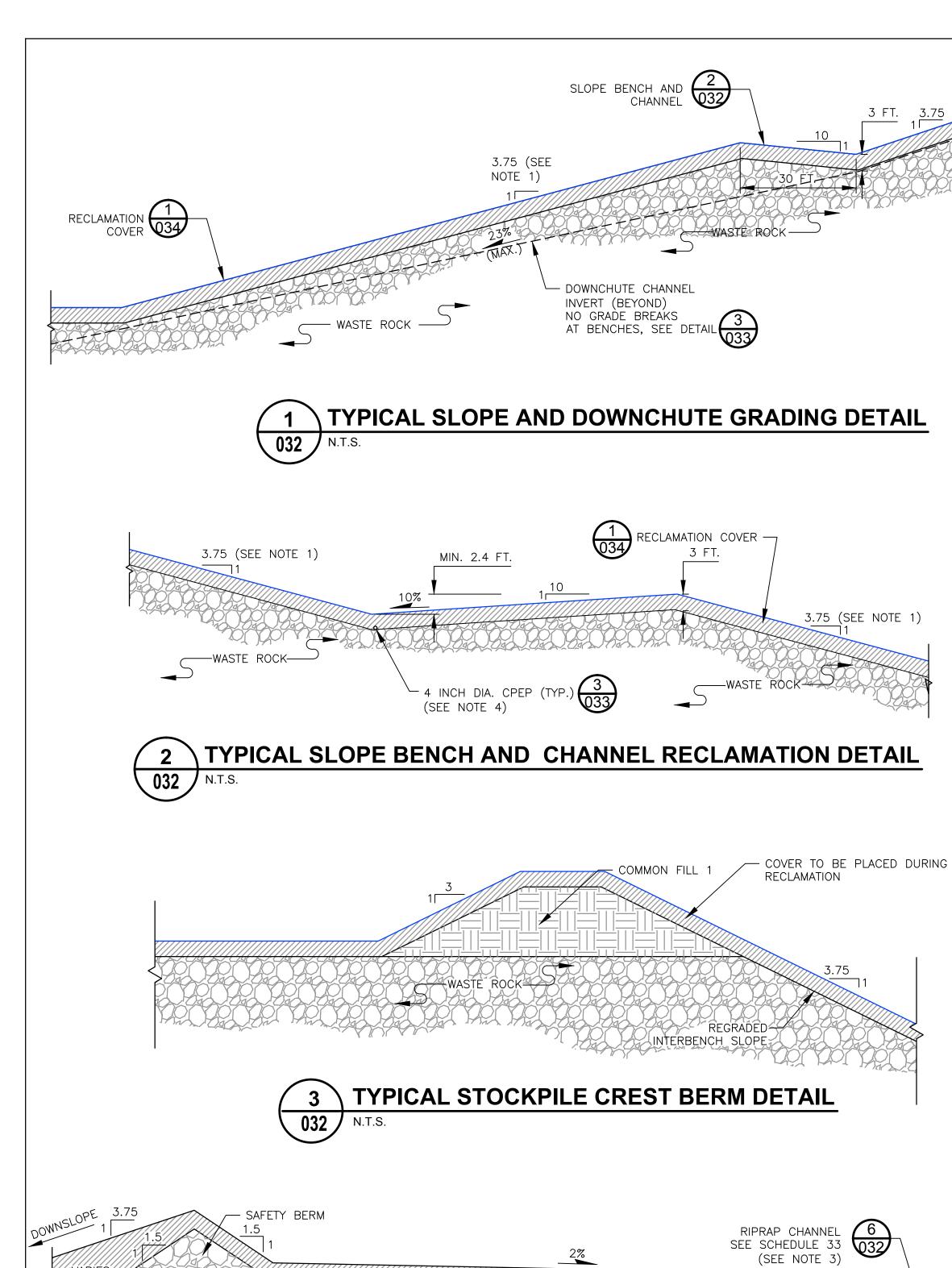
- 1. STOCKPILE SIDE SLOPES AT ANGLE OF REPOSE.
- 2. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.
- 3. SEE CROSS SECTION LOCATIONS ON DRAWINGS 3, 4, 5, 26, AND 27

DESIGN SECTIONS 餐 POLY MET MINING, INC. NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA

ORE SURGE PILE

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

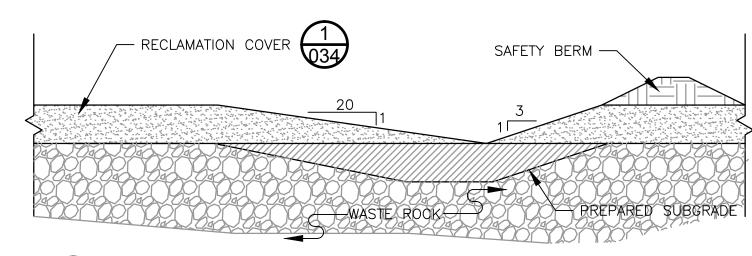
Golder Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com Associates REV



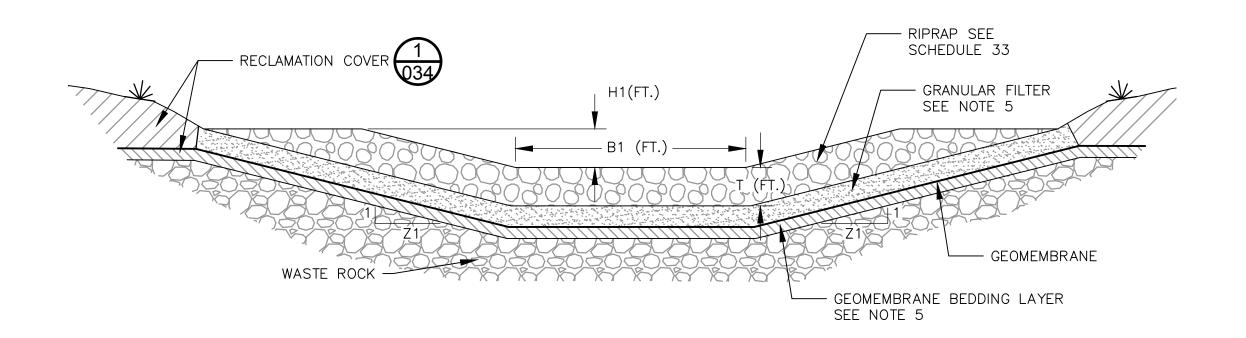
COVER TO BE PLACED WHEN

STOCKPILE OPERATIONS ARE COMPLETE

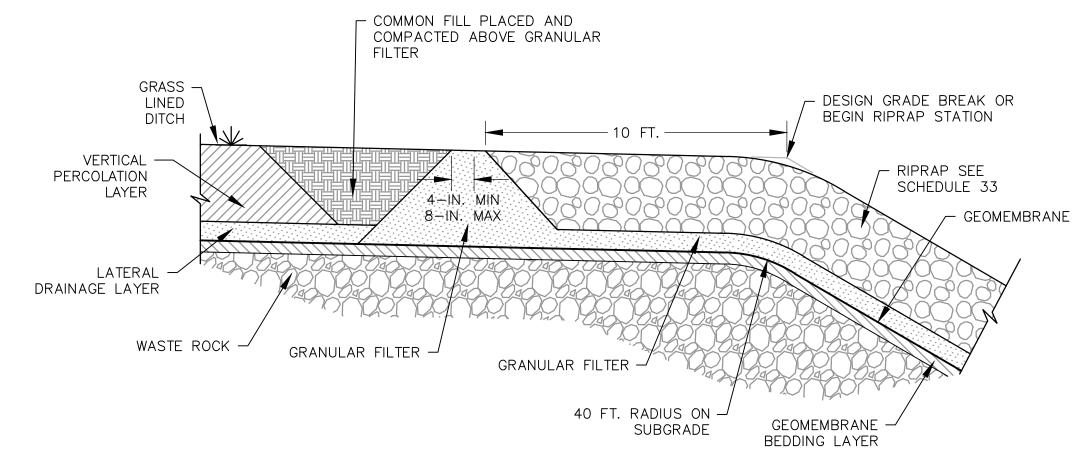
STOCKPILE RAMP TYPICAL DETAIL



TYPICAL TOP SURFACE CHANNEL SECTION



TYPICAL RIPRAP-LINED CHANNEL AND DOWNCHUTE N.T.S. (SEE SCHEDULE 33 FOR DIMENSIONS - SKP-033)



UPSTREAM END OF RIPRAP CHANNEL 032 N.T.S.

NOTES

- 1. THE MAXIMUM SLOPE GRADES ARE 3.75H:1V FOR RECLAIMED STOCKPILE
- 2. ASSUME 1.4H:1V INTERBENCH SLOPES FOR ACTIVE AREAS (EQUAL TO NOMINAL ANGLE OF REPOSE FOR WASTE ROCK MATERIAL). REGRADE PRIOR TO PLACEMENT OF RECLAMATION COVER.
- 3. SEE SCHEDULE 33 ON DRAWING SKP-033.
- 4. AT BASE OF COVER SYSTEM GRANULAR DRAINAGE LAYER PLACE DRAIN PIPE AT SLOPE-BENCH INTERSECTION. PIPE TO BE CONTINUOUS ALONG BENCHES BETWEEN DOWNCHUTE CHANNELS.
- 5. RIPRAP-LINED CHANNEL AND DOWNCHUTE DETAILS REPRESENT PRELIMINARY DESIGNS. DETAILED DIMENSIONS AND TECHNICAL SPECIFICATIONS TO BE PROVIDED PRIOR TO CONSTRUCTION, I.E. AS A PART OF FINAL DESIGN.
- 6. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

Associates

SKP-032

PLANT DRAWING NUMBER:

POLYMET

DWG. NO.

AS SHOWN

CATEGORY 1 STOCKPILE RECLAMATION AND OPERATIONS SURFACE WATER

MANAGEMENT DETAILS - SHEET 1 OF 2 芸 POLY MET MINING, INC.

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

Ph: (303) 980-0540 Fax: (303) 985-2080 www.golder.com

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

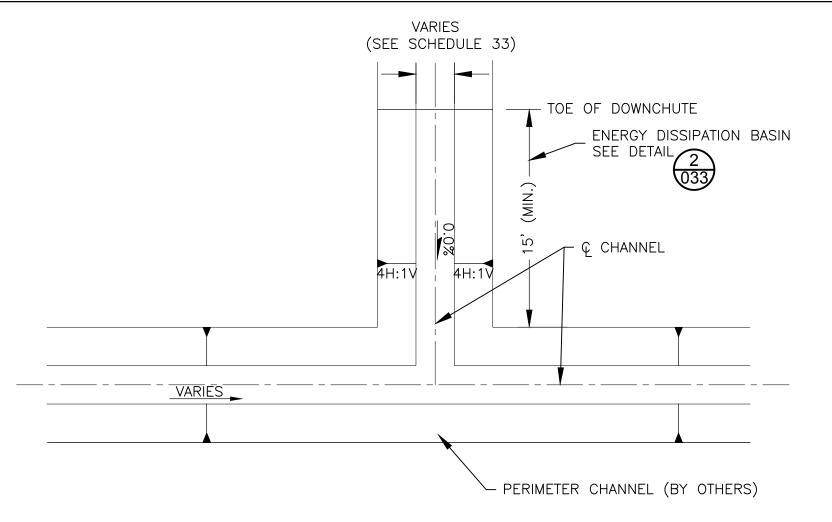
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VEF	DATE	DESCRIPTION	ISSUE STATUS						
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D	1/14/14	ISSUED FOR AGENCY REVIEW					CHECKED:		
E	4/10/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS				15	77		
F	5/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	FOR CONSTRUCTION	FOR CONSTRUCTION	FOR			SIGNATURE Allonson	GOLDER PROJECT NO.:
						PRINTED NAME BRENT R. BRONSON	113-2209		
			NOT APPROVED FOR CONSTRUCTION.			DATE <u>5/22/15</u> LICENSE # 46492	SCALE:		

VARIES 1

RIPRAP TO BE PLACED

DURING RECLAMATION

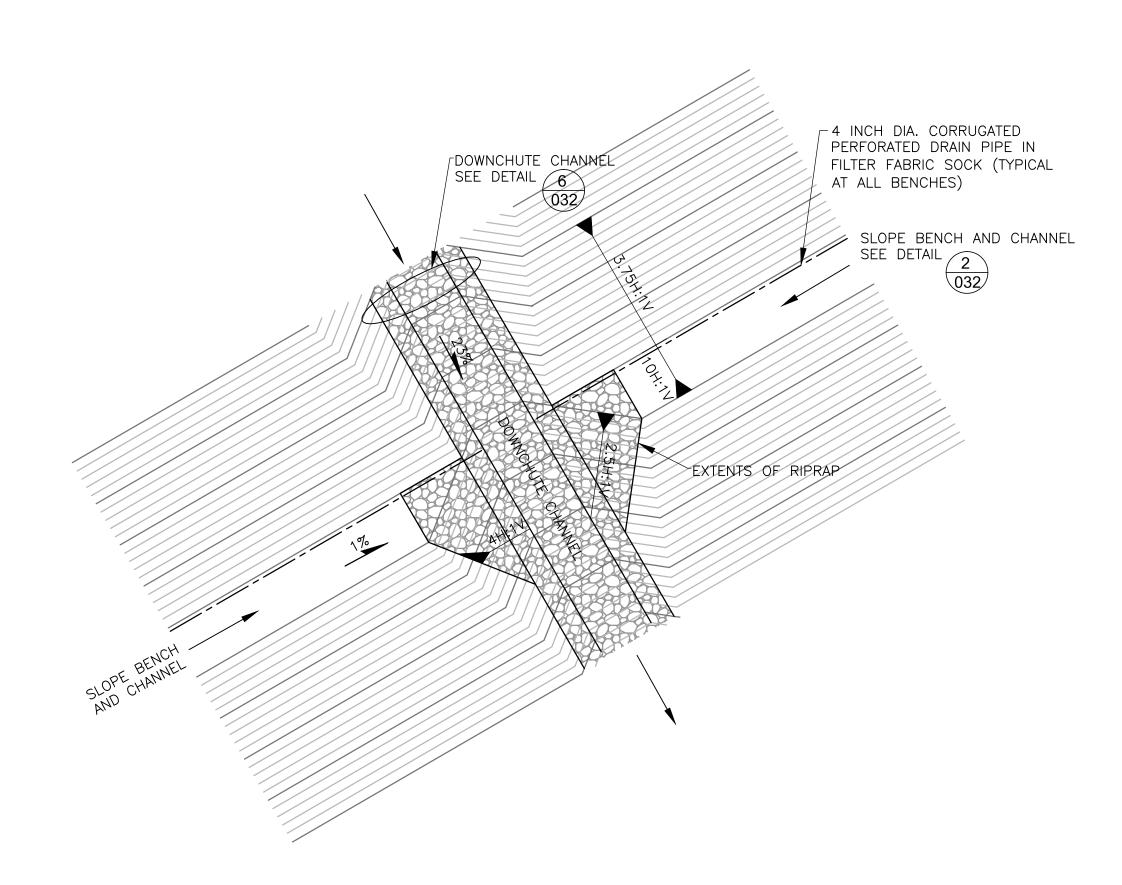


- RIPRAP SEE SCHEDULE 33 GRANULAR FILTER
SEE NOTE 1 GEOMEMBRANE BEDDING LAYER SEE NOTE 1 WASTE ROCK

> TYPICAL ENERGY DISSIPATION BASIN (SEE SCHEDULE 33 FOR DIMENSIONS)

033 N.T.S.

DOWNCHUTE CHANNEL CONFLUENCE DETAIL **033** N.T.S.



SCHEDULE 33: RIPRAP-LINED CHANNEL DIMENSIONS

CHANNEL ID	BOTTOM WIDTH, B1 (FT)	SIDE SLOPE, Z1 (H:1V)	MIN. DEPTH, H1 (FT)	RIPRAP SIZE, D ₅₀ (IN)	RIPRAP LAYER THICKNESS, T (FT)	MAX SLOPE (FT/FT)
DC1-A	20	4	3	12	2	0.23
DC1-B	20	4	3	12	2	0.23
DC1-C	25	4	3	12	2	0.23
DC1-D	20	4	3	12	2	0.23
DC1-E	25	4	3	12	2	0.23
DC1-F	20	4	3	9	1.5	0.23
DC1-G	20	4	3	12	2	0.23
DC1-HRE	8	4	3	9	1.5	0.06
DC1-H	20	4	3	9	1.5	0.23
DC1-HRS	8	4	3	9	1.5	0.06
DC1-HRU	8	4	3	9	1.5	0.07
DC1-I	20	4	3	12	2	0.23
DC1-J	20	4	3	18	3	0.23
DC1-K	25	4	3	12	2	0.23
DC1-L	25	4	3	12	2	0.23

NOTES

- ENERGY DISSIPATION BASIN DETAIL REPRESENTS PRELIMINARY DESIGN. DETAILED DIMENSIONS AND TECHNICAL SPECIFICATIONS TO BE PROVIDED PRIOR TO CONSTRUCTION, I.E. AS A PART OF FINAL DESIGN.
- 2. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

3 SLOPE BENCH AND CHANNEL TO DOWNCHUTE TRANSITION

PLANT DRAWING NUMBER:

SKP-033

CATEGORY 1 STOCKPILE RECLAMATION AND OPERATIONS SURFACE WATER MANAGEMENT DETAILS - SHEET 2 OF 2

VER DATE DESCRIPTION ISSUE STATUS A 12/02/11 ISSUED FOR REVIEW FOR INCLUSION IN ROCK AND OVERBURDEN MANAGEMENT PLAN (ROMP) ISSUED I HEREBY CERTIFY THAT THIS PLAN,
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¥ POLYMET

DWG. NO.

113-2209

AS SHOWN

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

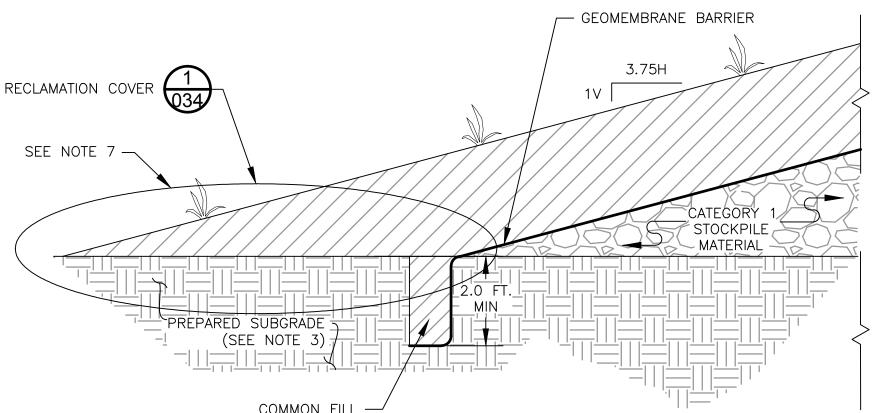
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E 4/10/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

F | 5/22/15 | ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

RECLAMATION COVER GEOMEMBRANE -BARRIER

RECLAMATION TO OPERATIONAL AREA TIE IN DETAIL



5 GEOMEMBRANE COVER ANCHOR TRENCH DETAIL

- 1. TEMPORARY SLOPE BENCH CHANNEL SHOULD BE CONSTRUCTED WITH MINIMUM DEPTH OF 2.4 FT. ON THE BENCHES BY GRADING CHANNEL SIDE SLOPES TO 10H:1V ON 30 FT. WIDE BENCHES.
- 2. STOCKPILE GEOMETRY DURING OPERATIONS BASED ON ASSUMED WASTE ROCK ANGLE OF REPOSE OF 35.5
- 3. GEOTECHNICALLY UNSUITABLE SOILS TO BE REMOVED AND REPLACED WITH COMPACTED STRUCTURAL FILL WITHIN 100 FT. OF CATEGORY 1 STOCKPILE PERIMETER LIMITS.
- 4. ON TOP OF STOCKPILE ON 1% SLOPE AREAS, PLACE 4 INCH DIAMETER PERFORATED CORRUGATED POLYETHYLENE PIPE (CPEP) WITH FILTER FABRIC SOCK AT 75 FOOT SPACING TO FACILITATE DRAINAGE OF GRANULAR DRAINAGE LAYER TO TOP SURFACE CHANNEL. PIPE LOCATION TO BE FIELD FIT.
- 5. AT STOCKPILE BENCHES, PLACE 4 INCH PERFORATED CPEP DRAIN PIPE WITH FILTER FABRIC SOCK AT BASE OF COVER SYSTEM GRANULAR DRAINAGE LAYER AT SLOPE-BENCH INTERSECTION WITH OUTFLOW DIRECTED
- 6. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

GOLDER PROJECT NO.:

SCALE:

113-2209

AS SHOWN

Dronson

PRINTED NAME BRENT R. BRONSON

DATE <u>5/22/15</u> LICENSE # 46492

Signature 🚄

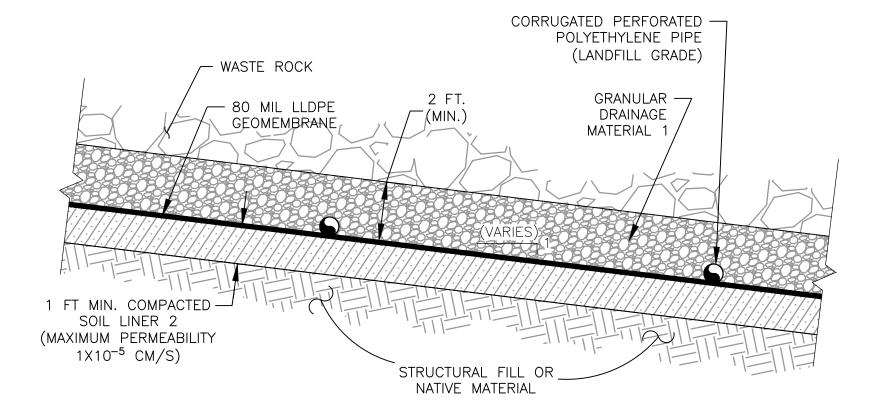
CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.

- 7. 7EDGE OF LINER TO TIE IN TO CATEGORY 1 STOCKPILE GROUNDWATER CONTAINMENT SYSTEM.
- 8. REFER TO UNIFIED SOIL CLASSIFICATION SYSTEM FOR COVER SOIL DESCRIPTION.

CATEGORY 1 STOCKPILE PHASED COVER DESIGN ¥ POLY MET MINING, INC. NORTHMET PROJECT POLYMET HOYT LAKES, MINNESOTA GOLDER ASSOCIATES INC. 44 UNION BOULEVARD, SUITE 300 LAKEWOOD, CO USA 80233

Golder Ph: (303) 980-0540 Fax: (303) 985-2080 **Associates** www.golder.com REV DWG. NO. SKP-034

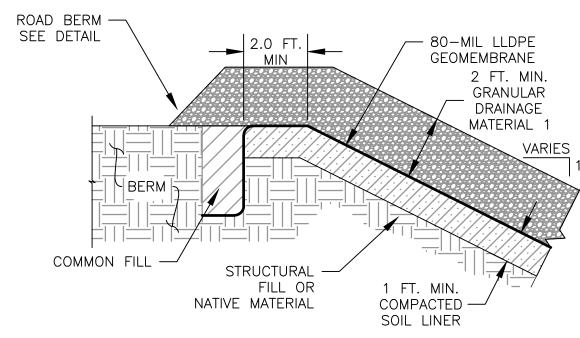


2 FT. MIN. CORRUGATED PERFORATED — GRANULAR POLYETHYLENE PIPE DRAINAGE (LANDFILL GRADE) WASTE ROCK MATERIAL MATERIAL 1 -80 MIL LLDPE GEOMEMBRANE 1 FT MIN. SOIL LINER 1 (MAXIMUM PERMEABILITY 1X10 6 CM/S) NATIVE MATERIAL

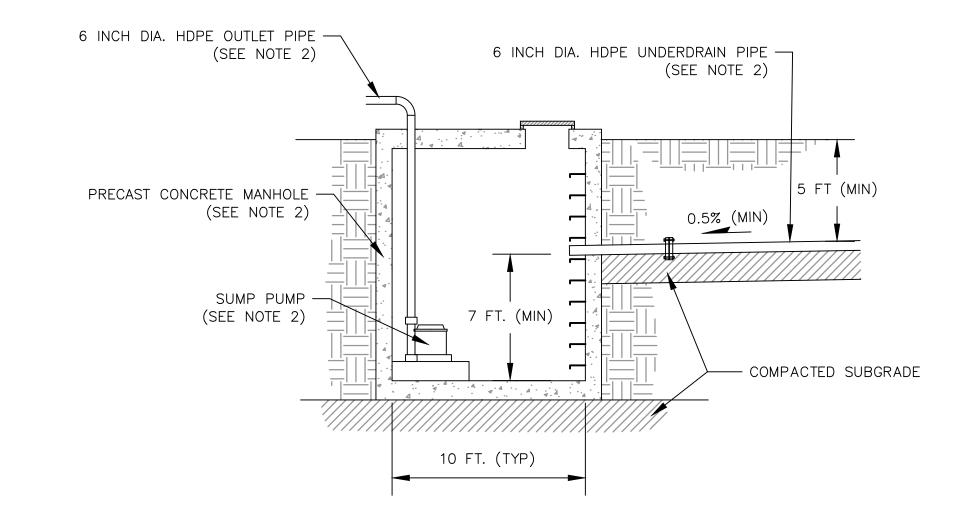
> **CATEGORY 4 STOCKPILE AND ORE SURGE PILE LINER 035** N.T.S.

TYPICAL FOUNDATION UNDERDRAIN 035 N.T.S.

CATEGORY 2/3 STOCKPILE LINER



GEOMEMBRANE LINER ANCHOR TRENCH DETAIL 035

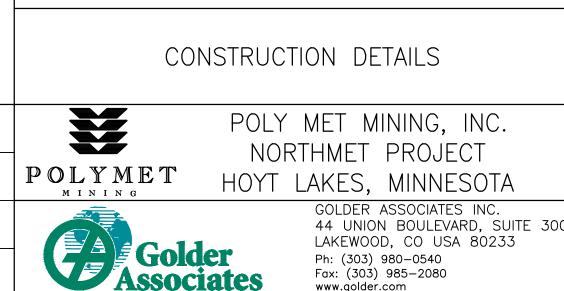


5 UNDERDRAIN SUMP MANHOLE

NOTES

1. SEE GENERAL NOTES AND LEGEND ON DRAWING 002.

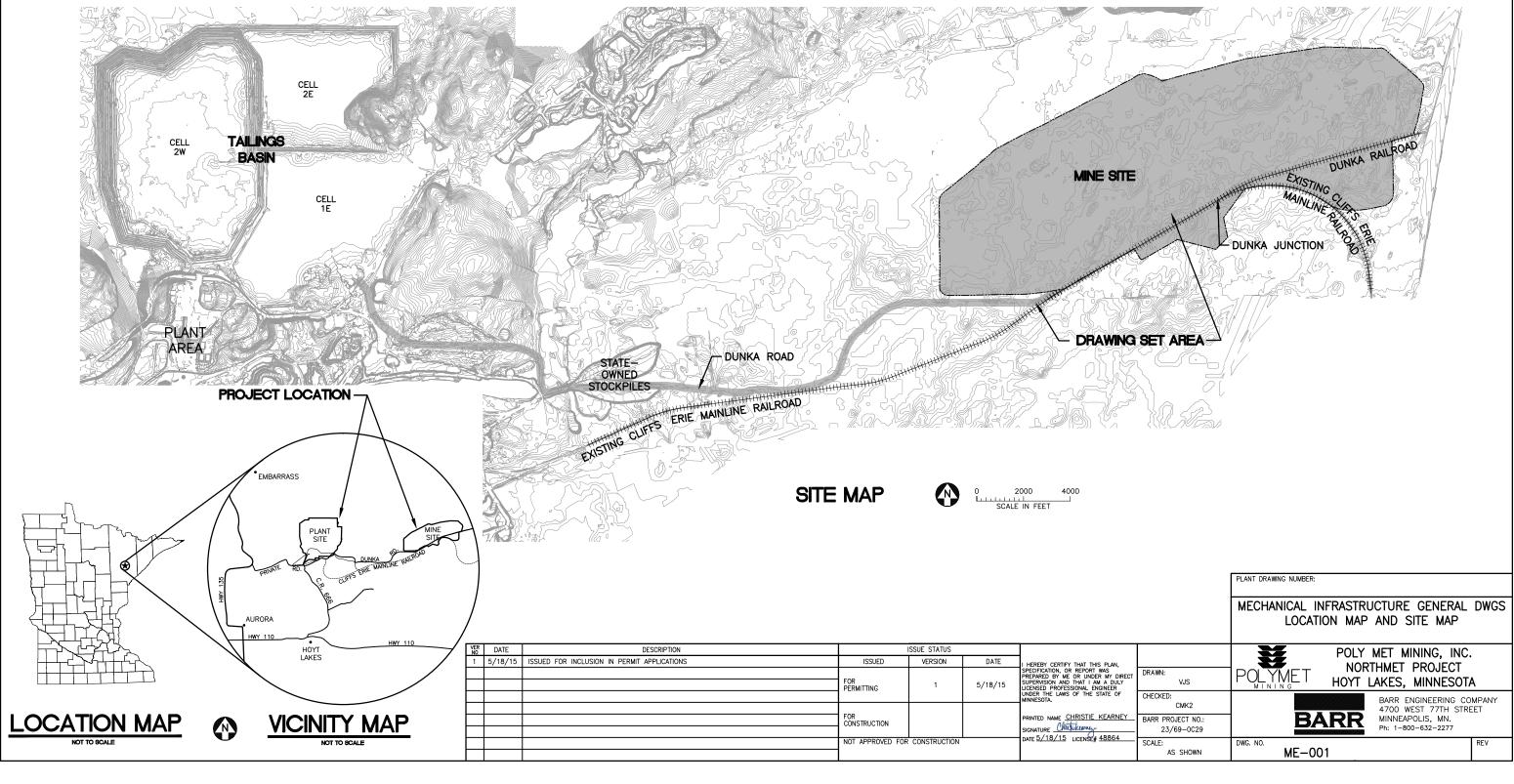
2. UNDERDRAIN SUMP MANHOLE DIMENSIONS, SUMP PUMP CAPACITY AND PIPE DIMENSIONS ARE PRELIMINARY AND WILL BE SIZED BASED ON ENCOUNTERED FIELD CONDITIONS.



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Mine Site Mechanical Infrastructure



MECHANICAL INFRASTRUCTURE LEGEND

CENTRAL PUMPING STATION

PROPOSED MINE DRAINAGE PIPE

PROPOSED MINE DRAINAGE PIPE

PROPOSED SUMP MANHOLE

PROPOSED MINE DRAINAGE CULVERT

PROPOSED TREATED WATER PIPELINE

PROPOSED HAUL ROAD MINE DRAINAGE DITCH

PROPOSED STOCKPILE LINER OUTLET PIPE

PROPOSED MINE DRAINAGE WATERSHED

MINE DRAINAGE

TOP OF DIKE BENCH

----<

GENERAL

PROPOSED TREATED WATER PIPELINE EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR PROPOSED CULVERT (NON-MINE DRAINAGE) ---1000----PROPOSED CONTOUR - MAJOR PROPOSED CONTOUR - MINOR ---1000----

OTHER FACILITY PROPOSED CONTOUR - MAJOR OTHER FACILITY PROPOSED CONTOUR - MINOR PROPOSED RAILROAD EXISTING RAILROAD

PROPOSED ACCESS ROADS EXISTING ROAD MINE SITE BOUNDARY (<u>*</u> WETLAND BOUNDARY

+/+/+HAUL ROAD

TREATED WATER PIPELINE

FXISTING POWER POLE EXISTING TRAIL EXISTING UNIMPROVED TRAIL ----R/W---RIGHT OF WAY EXISTING STRUCTURES TRFF LINE EXISTING OVERHEAD ELECTRIC EXISTING UNDERGROUND ELECTRIC PROPOSED TREATED WATER PIPELINE PROPOSED CULVERT (NON-MINE DRAINAGE) PROPOSED MINE DRAINAGE PIPE

NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH

SHEET INDEX

SHEET NO. TITLE

MECHANICAL INFRASTRUCTURE GENERAL DRAWINGS

ME-001 LOCATION MAP AND SITE MAP
ME-002 LECEND & SHEET INDEX
ME-003 MINE SITE - MINE DRAINAGE FLOW DIAGRAM
ME-004 MINE SITE - SUMP, POND AND PIPE DETAIL TABLES

TREATED WATER PIPELINE DRAWINGS

TWP-001 GENERAL LAYOUT AND SHEET INDEX TWP-002 PLAN & PROFILE STATION 113+70 TO 130+00 TWP-003 PLAN & PROFILE STATION 130+00 TO 190+00 TWP-004 PLAN & PROFILE STATION 190+00 TO 250+00 TWP-005 PLAN & PROFILE STATION 250+00 TO 310+00 | TWP-005 | PLAN & PROFILE SIATION 250+00 | 10 310+00 | TWP-006 | PLAN & PROFILE STATION 370+00 | TO 430+00 | TWP-008 | PLAN & PROFILE STATION 430+00 | TO 490+00 | TWP-009 | PLAN & PROFILE STATION 430+00 | TO 490+00 | TWP-010 | PLAN & PROFILE STATION 490+00 | TO 512+50 | TWP-011 | DETAILS | TWP-012 | DETAILS | TWP-013 | DETAILS | TWP-014 | TWP-015 | DETAILS | TWP-015 | DETAILS | TWP-016 | TWP-017 | DETAILS | TWP-017 | TWP-017 | DETAILS | TWP-018 | TWP-019 | DETAILS | TWP-019 | TWP-TWP-011 DETAILS IN CLOSURE

CENTRAL PUMPING STATION (CPS) DRAWINGS

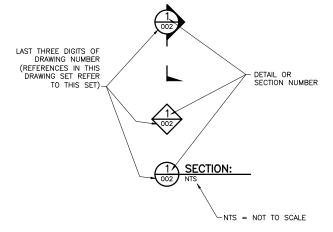
CPS-001 SITE PLAN
CPS-002 PUMP STATION PLAN
CPS-003 PROCESS FLOW DIAGRAM

SHEET NO. TITLE

MINE DRAINAGE DRAWINGS

MD-001 YEAR 1 GENERAL LAYOUT
MD-002 YEAR 11 GENERAL LAYOUT
MD-003 SUMP SOSP & MD-SOSP GRADING PLAN
MD-004 SUMP S4 & MD-S4 GRADING PLAN
MD-005 SUMP S23-1 & MD-S23-1 GRADING PLAN
MD-006 SUMP S23-2 GRADING PLAN
MD-007 SUMP S23-3 & MD-S23-3 GRADING PLAN
MD-008 POND MD-0SLA GRADING PLAN
MD-009 POND MD-OSLA GRADING PLAN
MD-009 POND MD-RTH GRADING PLAN
MD-010 POND MD-HTP GRADING PLAN MD-014 SUMP/POND TYPICAL DETAILS
MD-015 PIPE TYPICAL DETAILS MD-016 CLOSURE PLAN

DRAWING NUMBERING



ABBREVIATIONS

ACRE-FEET AVERAGE CATEGORY CENTERLINE AVE CAT € CMP CORRUGATED METAL PIPE CPS DIP DV DWG CENTRAL PUMPING STATION DUCTILE IRON PIPE DRAIN VALVE DRAWING ELEVATION
GALLONS
GEOSYNTHETIC CLAY LINER

EL.
GAL
GCL
GPM
HDPE
HRE
HRE
HRN
HRW
INV
LF
MD
MG
MH
MIL
MIN
MnDOT GALLONS PER MINUTE
HIGH-DENSITY POLYETHYLENE
HAUL ROAD CENTRAL
HAUL ROAD EAST HAUL ROAD NORTH HAUL ROAD WEST INVERT LINEAR FEET
MINE DRAINAGE
MILLION GALLONS

MEASUREMENT OF LINER THICKNESS; A MIL IS A THOUSANDTH OF AN INCH

MEASUREMENT OF LINER THICKNESS; A MIL IS MINIMUM MINNESOTA DEPARTMENT OF TRANSPORTATION OVERBURDEN STORAGE AND LAYDOWN AREA ORE SURGE PILE PIPELINE POUNDS PER SQUARE INCH

OSLA OSP PL PSI RTH SDR STA RAIL TRANSFER HOPPER STANDARD DIMENSION RATIO STATION
WASTE ROCK STOCKPILE STOCKPILE-TDH TWP TYP TOTAL DESIGN HEAD TREATED WATER PIPELINE VACUUM/AIR RELIEF V/A

WASTE WATER TREATMENT FACILITY

PLANT DRAWING NUMBER:

MECHANICAL INFRASTRUCTURE GENERAL DWGS LEGEND AND SHEET INDEX

ER IO	DATE	DESCRIPTION		SSUE STATUS			
	5/18/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.	
			FOR PERMITTING	1	5/18/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: VJS
						UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:
							CMK2
			FOR CONSTRUCTION			PRINTED NAME CHRISTIE KEARNEY SIGNATURE	BARR PROJECT NO.:
						DATE 5/18/15 LICENSE# 48864	23/69-0C29
			NOT APPROVED FOR CONSTRUCTION			DATE 37 187 13 LICENSE# 46864	SCALE:
							AS SHOWN

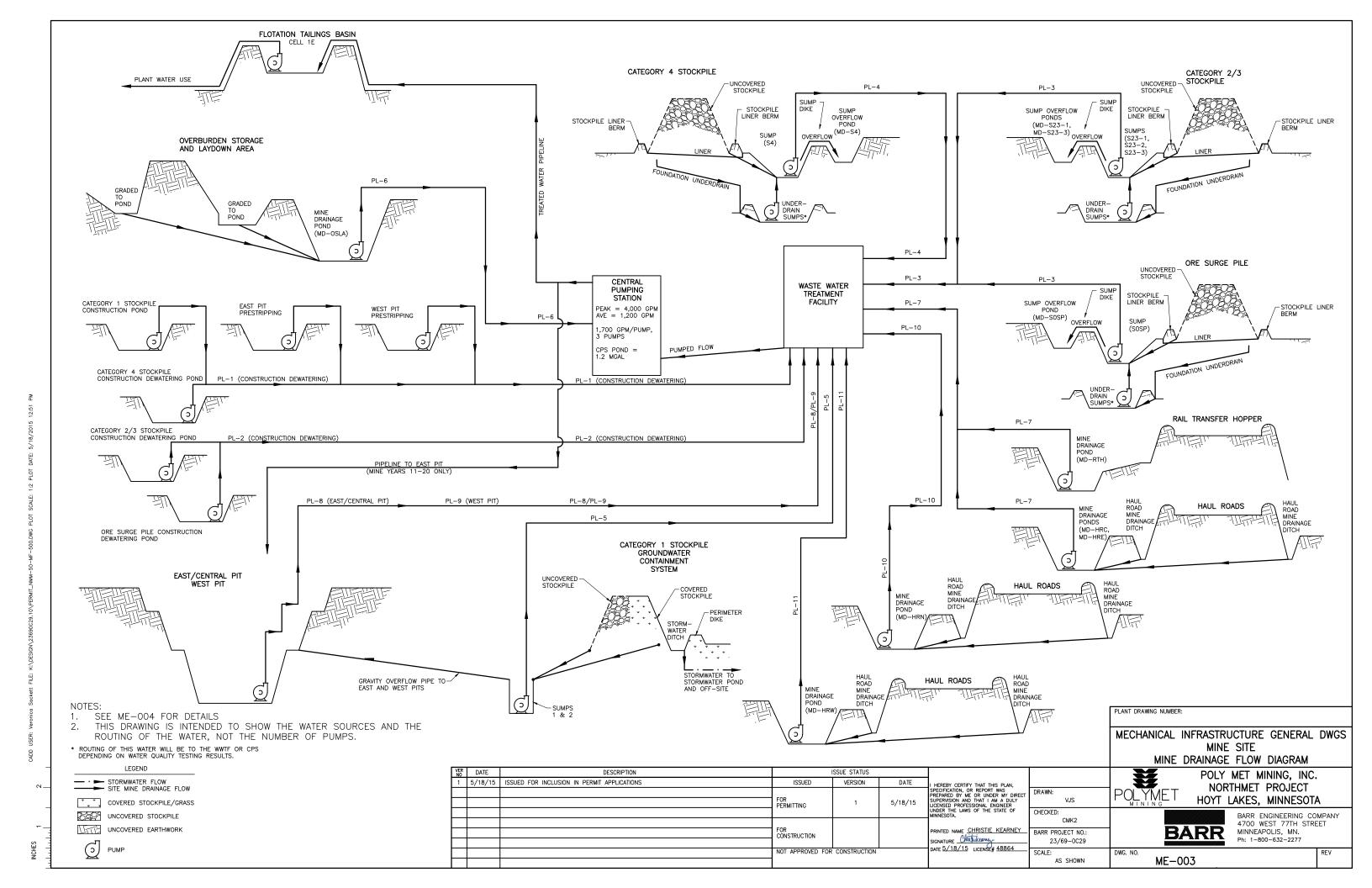
POLYME

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR

ME-002

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277



SUMPS - TEMPORARY

				DESIGN	APPROXIMATE PUMP CAPACITY			ACTUAL		
ID	DESCRIPTION	OBJECTIVES	MINE YEARS	VOLUME* (GAL)	GPM	TDH (FT)	LINER TYPE	VOLUME* (GAL)	OVERFLOWS TO	SHOWN ON SHEET #
S23-1	CATEGORY 2/3 STOCKPILE SUMP	PROVIDE RUNOFF STORAGE FOR THE 10 YEAR 24 HOUR EVENT	1–19	4,855,000	190	210	MINE DRAINAGE SUMP LINER	4,855,000	MD-S23-1	MD-005
S23-2	CATEGORY 2/3 STOCKPILE SUMP	PROVIDE RUNOFF STORAGE FOR THE 10 YEAR 24 HOUR EVENT	3–17	3,878,000	150	230	MINE DRAINAGE SUMP LINER	3,910,000	MD-S23-1	MD-006
S23-3	CATEGORY 2/3 STOCKPILE SUMP	PROVIDE RUNOFF STORAGE FOR THE 10 YEAR 24 HOUR EVENT	6-16	2,151,000	90	270	MINE DRAINAGE SUMP LINER	2,151,000	MD-S23-3	MD-007
S4	CATEGORY 4 STOCKPILE SUMP	PROVIDE RUNOFF STORAGE FOR THE 10 YEAR 24 HOUR EVENT	1-11	3,291,000	130	50	MINE DRAINAGE SUMP LINER	4,073,000	MD-S4	MD-004
SOSP	ORE SURGE PILE SUMP	PROVIDE RUNOFF STORAGE FOR THE 10 YEAR 24 HOUR EVENT	1-20	2,770,000	80	90	MINE DRAINAGE SUMP LINER	2,835,000	MD-SOSP	MD-003

^{*} DESIGN VOLUME REFLECTS THE VOLUME REQUIRED BASED ON THE DESIGN NEEDS; WHEREAS ACTUAL VOLUME REFLECTS THE VOLUME SHOWN IN THE ATTACHED DRAWING SET. ACTUAL VOLUME DOES NOT INCLUDE ADDITIONAL VOLUME FROM 3 FEET OF FREEBOARD

MINE PIT SUMPS

				INITIAL SUMP		APPROXIMATE P - INITIAL YEAR YEA		
ID	DESCRIPTION	OBJECTIVES	MINE YEARS	CAPACITY (AC-FT)	MAXIMUM SUMP CAPACITY (AC-FT)	GPM	TDH (FT)	OVERFLOWS TO
WP-W	WEST PIT — WEST SUMP	*COLLECTION IN PIT	2-20	6.6	14.0	YEAR 2: 820 YEAR 20: 1,590	YEAR 2: 120 YEAR 20: 740	NONE
WP-E	WEST PIT — EAST SUMP	*COLLECTION IN PIT	10-20	4.7	9.4	YEAR 10: 530 YEAR 20: 1,050	YEAR 10: 110 YEAR 20: 350	NONE
EP	EAST PIT	*COLLECTION IN PIT	1-20	11.6	19.5	YEAR 1: 1,520 YEAR 11: 2,340	YEAR 1: 120 YEAR 11: 750	NONE
CP	CENTRAL PIT	*COLLECTION IN PIT	11-20	3.8	3.8	YEAR 11: 440 YEAR 16: 440	YEAR 1: 60 YEAR 16: 390	NONE

^{*} PIT COLLECTION IS BASED ON 40% OF THE AVERAGE ANNUAL SNOW MELT OCCURRING WITHIN ONE DAY AND THE PUMP CAPACITY DESIGNED TO REMOVE THAT SNOW MELT EVENT WITHIN 3 DAYS

SUMPS - PERMANENT

				MINIMUM		ATE PUMP			
ID	DESCRIPTION	OBJECTIVES	MINE YEARS	CAPACITY (GAL)	GРM	TDH (FTI)	LINER TYPE	OVERFLOWS TO	SHOWN ON SHEET #
SUMP 1	CATEGORY 1 STOCKPILE SUMP – EAST	COLLECTION FOR GROUNDWATER CONTAINMENT SYSTEM	1-20+	NA – MANHOLE	7,200	50	NA - MANHOLE	EAST PIT	SEE CATEGORY 1 STOCKPILE
SUMP 2	CATEGORY 1 STOCKPILE SUMP – WEST	COLLECTION FOR GROUNDWATER CONTAINMENT SYSTEM	1-20+	NA – MANHOLE	7,200	50	NA - MANHOLE	WEST PIT	CONTAINMENT SYSTEM DRAWING SET

NOTES:

- 1. ACTUAL PUMP, PIPE, AND POND SIZES WILL BE OPTIMIZED IN FINAL DESIGN

- 1. ACTOAL POWP, PIPE, AND POND SIZES WILL BE OPTIMIZED IN FINAL DESIGN
 2. STANDARDIZED PUMP SIZE TO BE DETERMINED DURING FINAL DESIGN
 3. SOIL LINER 2 IS SHOWN IN DETAIL 2 ON SHEET CPS-002
 4. MINE DRAINAGE SUMP LINER IS SHOWN IN DETAIL 1 ON SHEET MD-014
 5. MINE DRAINAGE POND LINER IS SHOWN IN DETAIL 2 ON SHEET MD-014
 6. ALL PUMP CAPACITY FLOWS AND TDH VALUES HAVE BEEN ROUNDED

MINE DRAINAGE PONDS

				DESIGN	APPROXIMATE PUMP CAPACITY			ACTUAL		
ID	DESCRIPTION	OBJECTIVES	MINE YEARS	VOLUME* (GAL)	GРM	TDH (FT)	LINER TYPE	VOLUME* (GAL)	OVERFLOWS TO	SHOWN ON SHEET #
CPS	CENTRAL PUMPING STATION POND	STORE WATER FOR CPS CONVEYANCE	1-20+	1,200,000	4,000	450	SOIL LINER 2	1,200,000	NONE	CPS-001
MD-S23-1	CATEGORY 2/3 STOCKPILE SUMP OVERFLOW POND	PROVIDE SUMP OVERFLOW STORAGE UP TO THE 100 YEAR 24 HOUR EVENT	1-19	6,973,000	NA	NA	MINE DRAINAGE POND LINER	7,006,000	NONE	MD-005/ MD-006
MD-S23-3	CATEGORY 2/3 STOCKPILE SUMP OVERFLOW POND	PROVIDE SUMP OVERFLOW STORAGE UP TO THE 100 YEAR 24 HOUR EVENT	6-16	1,727,000	NA	NA	MINE DRAINAGE POND LINER	1,727,000	NONE	MD-007
MD-S4	CATEGORY 4 STOCKPILE SUMP OVERFLOW POND	PROVIDE SUMP OVERFLOW STORAGE UP TO THE 100 YEAR 24 HOUR EVENT	1-11	2,639,000	NA	NA	MINE DRAINAGE POND LINER	3,226,000	NONE	MD-004
MD-SOSP	ORE SURGE PILE SUMP OVERFLOW POND	PROVIDE SUMP OVERFLOW STORAGE UP TO THE 100 YEAR 24 HOUR EVENT	1-20	1,564,000	NA	NA	MINE DRAINAGE POND LINER	1,727,000	NONE	MD-003
MD-HRC	HAUL ROAD RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 100 YEAR 24 HOUR EVENT AND REDUCE TSS	1-20	1,988,000	40	80	MINE DRAINAGE POND LINER	2,248,000	NONE	MD-011
MD-HRE	HAUL ROAD RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 100 YEAR 24 HOUR EVENT AND REDUCE TSS	1-20	3,487,000	70	110	MINE DRAINAGE POND LINER	3,487,000	NONE	MD-010
MD-HRW	HAUL ROAD RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 100 YEAR 24 HOUR EVENT AND REDUCE TSS	2-20	1,206,000	30	70	MINE DRAINAGE POND LINER	1,303,000	NONE	MD-012
MD-HRN	HAUL ROAD RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 100 YEAR 24 HOUR EVENT AND REDUCE TSS	2-20	1,434,000	30	110	MINE DRAINAGE POND LINER	1,499,000	NONE	MD-013
MD-RTH	RAIL TRANSFER HOPPER RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 100 YEAR 24 HOUR EVENT AND REDUCE TSS	1-20	228,000	200	60	MINE DRAINAGE SUMP LINER	228,000	NONE	MD-009
MD-OSLA	OVERBURDEN STORAGE & LAYDOWN AREA RUNOFF POND	PROVIDE FLOOD STORAGE UP TO THE 25 YEAR 24 HOUR EVENT AND REDUCE TSS	1-20	3,487,000	100	90	NONE	4,725,000	NONE	MD-008
TEMP (VARIOUS)	STOCKPILE CONSTRUCTION RUNOFF PONDS AND PIT STRIPPING	TEMPORARY POND TO COLLECT RUNOFF DURING CONSTRUCTION	VARIES	VARIES	VARIES	VARIES	NONE	VARIES	NONE	NONE

^{*}DESIGN VOLUME REFLECTS THE VOLUME REQUIRED BASED ON THE DESIGN NEEDS; WHEREAS ACTUAL VOLUME REFLECTS THE VOLUME SHOWN IN THE ATTACHED DRAWING SET. ACTUAL VOLUME DOES NOT INCLUDE ADDITIONAL VOLUME FROM 3 FEET OF FREEBOARD (1 FOOT FOR MD-RTH)

<u>PIPING</u>

ID	DESCRIPTION	OBJECTIVES	WATER SOURCE	NOMINAL PIPI SIZES* (IN)
TWP	TREATED WATER PIPELINE	TRANSPORT WATER FROM THE CPS TO FLOTATION TAILINGS BASIN	CPS	20
PL-1	PIPELINE NUMBER 1	TRANSPORT CONSTRUCTION WATER TO THE WWTF	TEMP — CAT 1, CAT 4, EAST PIT & WEST PIT	2 TO 8
PL-2	PIPELINE NUMBER 2	TRANSPORT CONSTRUCTION WATER TO THE WWTF	TEMP - CAT 2/3 + OSP	2 TO 8
PL-3	PIPELINE NUMBER 3	TRANSPORT MINE DRAINAGE TO THE WWTF	CAT 2/3 & OSP	3 TO 8
PL-4	PIPELINE NUMBER 4	TRANSPORT MINE DRAINAGE TO THE WWTF	CAT 4	4
PL-5	PIPELINE NUMBER 5	TRANSPORT MINE DRAINAGE TO THE WWTF	CAT 1	28 TO 42
PL-6	PIPELINE NUMBER 6	TRANSPORT MINE DRAINAGE TO THE CPS	OSLA	3
PL-7	PIPELINE NUMBER 7	TRANSPORT MINE DRAINAGE TO THE WWTF	RTH, MD-HRE & MD-HRC	2 TO 6
PL-8	PIPELINE NUMBER 8	TRANSPORT MINE DRAINAGE TO THE WWTF	EAST PIT & CENTRAL PIT	12 TO 20
PL-9	PIPELINE NUMBER 9	TRANSPORT MINE DRAINAGE TO THE WWTF	WEST PIT	10 TO 22
PL-10	PIPELINE NUMBER 10	TRANSPORT MINE DRAINAGE TO THE WWTF	MD-HRN	2
PL-11	PIPELINE NUMBER 11	TRANSPORT MINE DRAINAGE TO THE WWTF	MD-HRW	2

PLANT DRAWING NUMBER:

MECHANICAL INFRASTRUCTURE GENERAL DWGS MINE SITE SUMP, POND AND PIPE DETAIL TABLES

R	DATE	DESCRIPTION		SSUE STATUS			
	5/18/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,	
			FOR PERMITTING	1		SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER W DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: VJS
						UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED: CMK2
			FOR CONSTRUCTION			PRINTED NAME CHRISTIE KEARNEY SIGNATURE	BARR PROJECT NO.: 23/69-0C29
			NOT APPROVED FOR	CONSTRUCTION		DATE 5/18/15 LICENSE# 48864	SCALE:



AS SHOWN

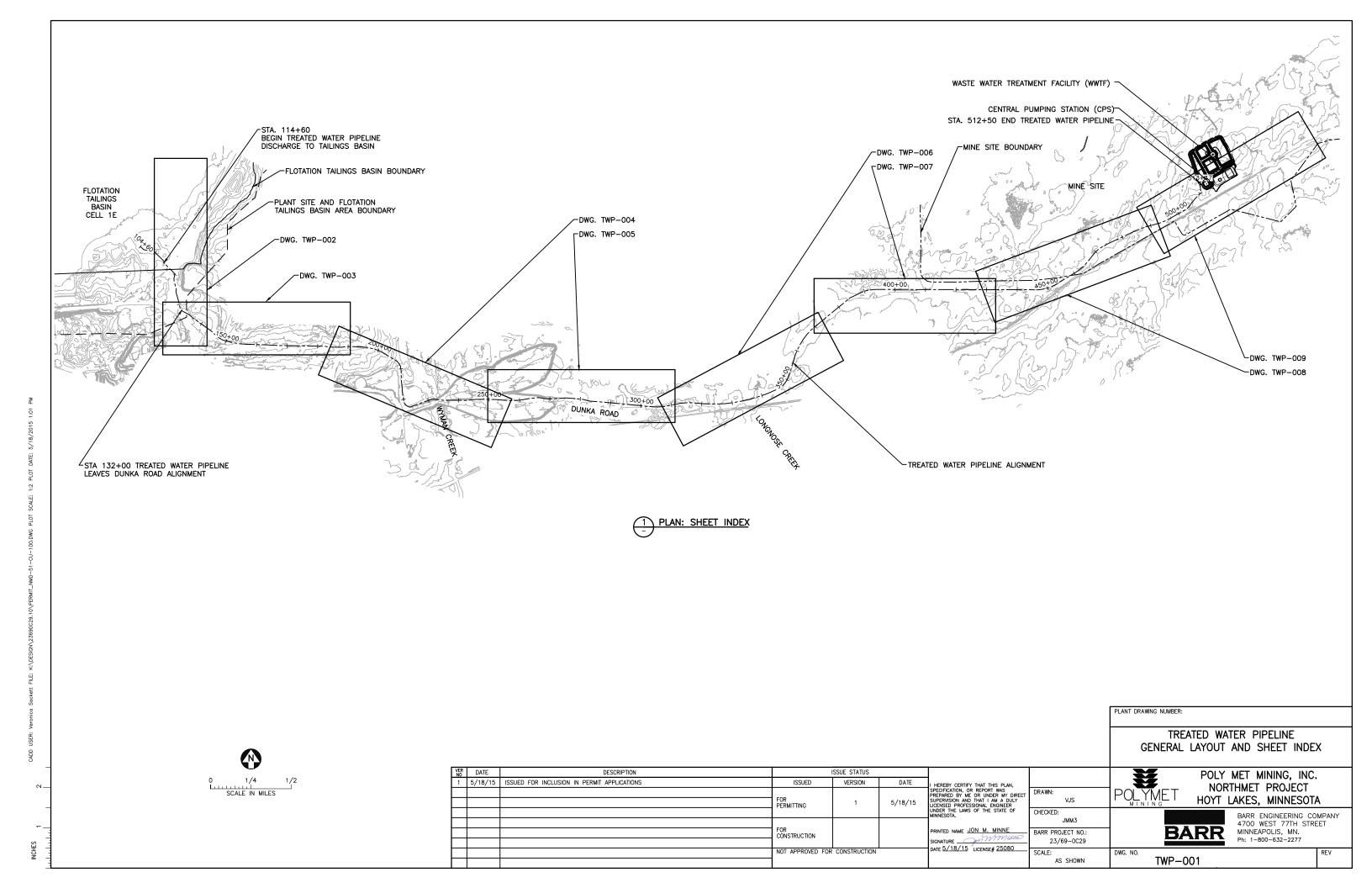
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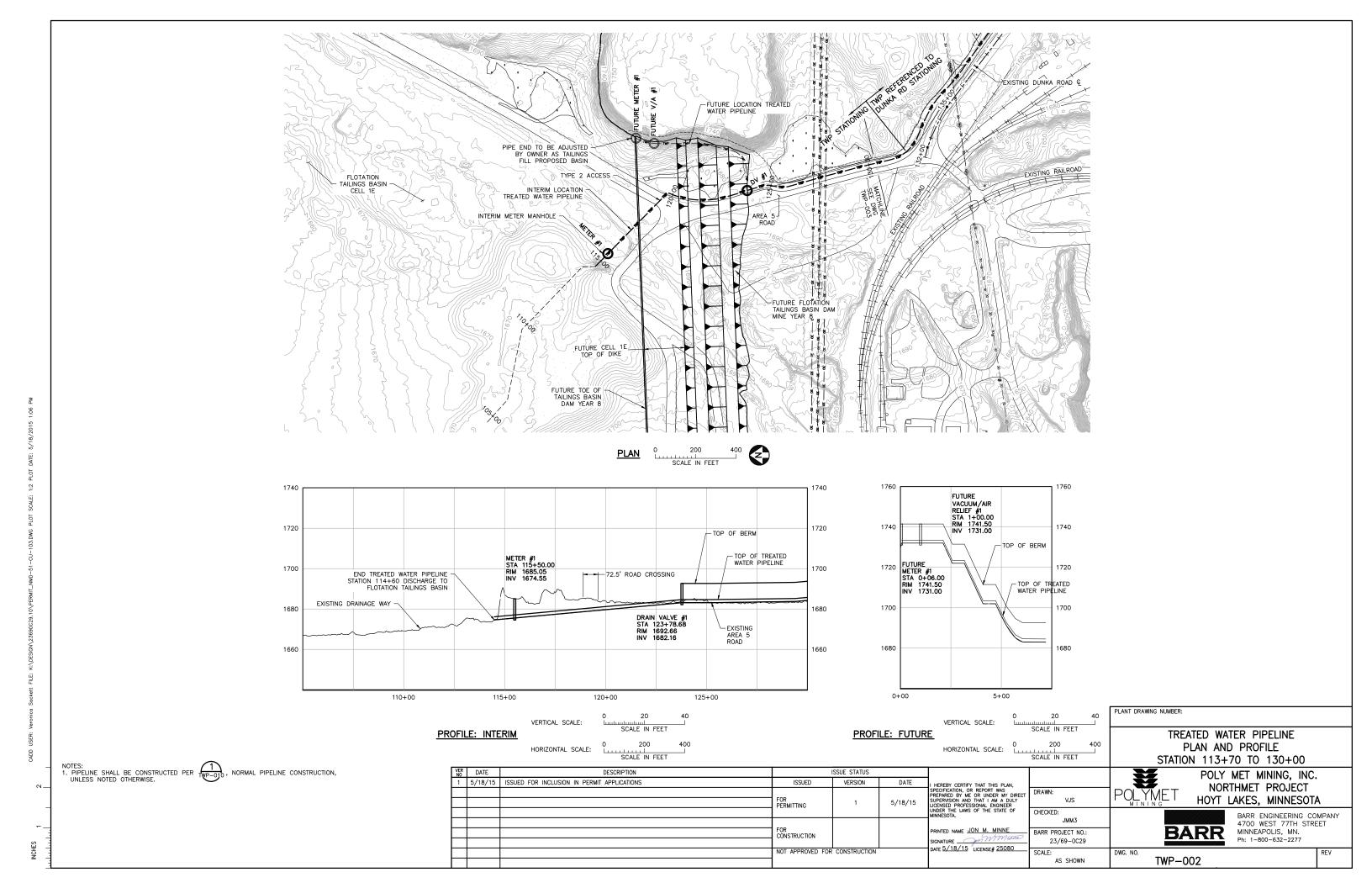
BARR

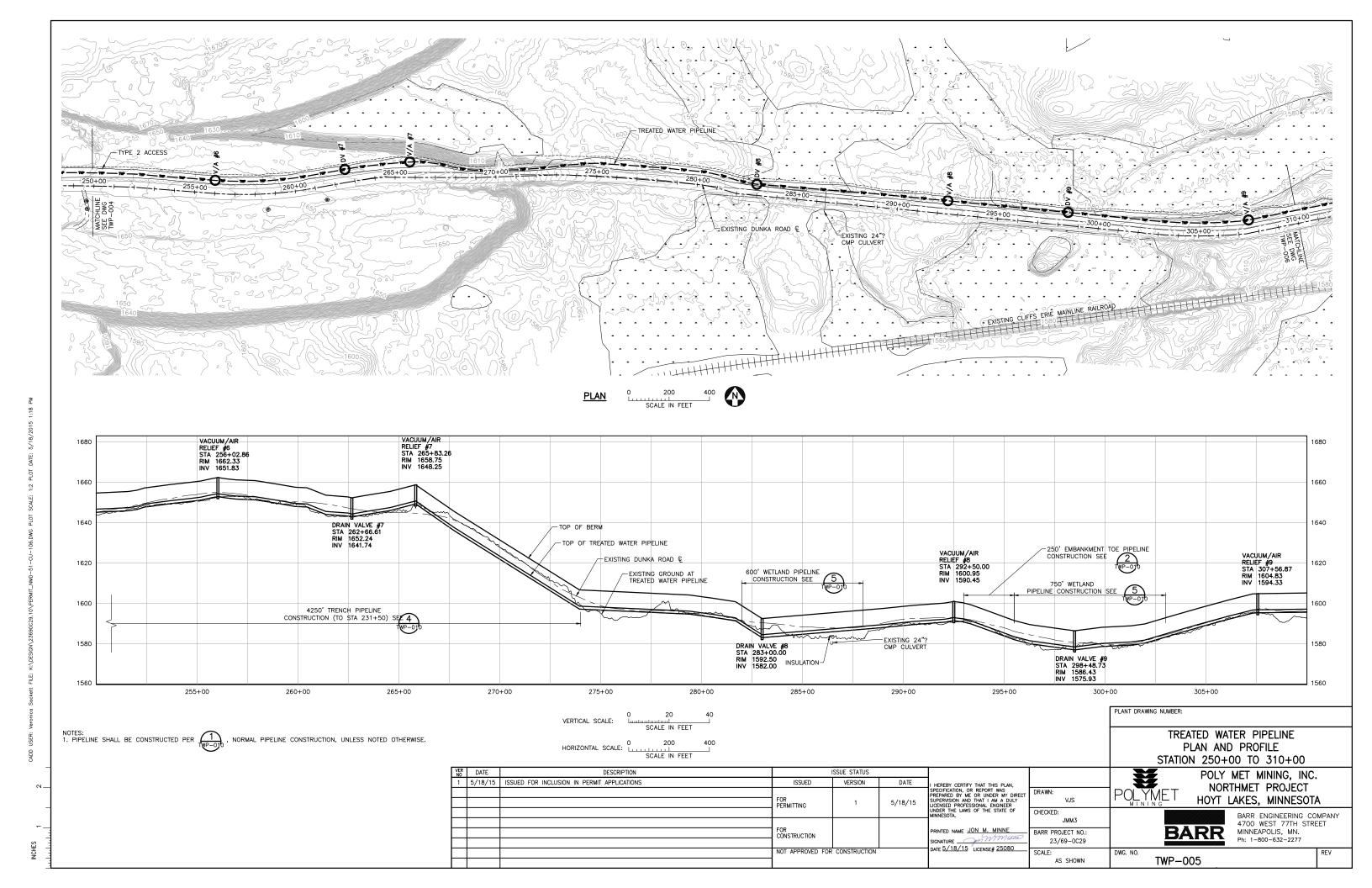
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

Ph: 1-800-632-2277

ME-004







- PROPOSED CENTRAL PUMPING STATION 5

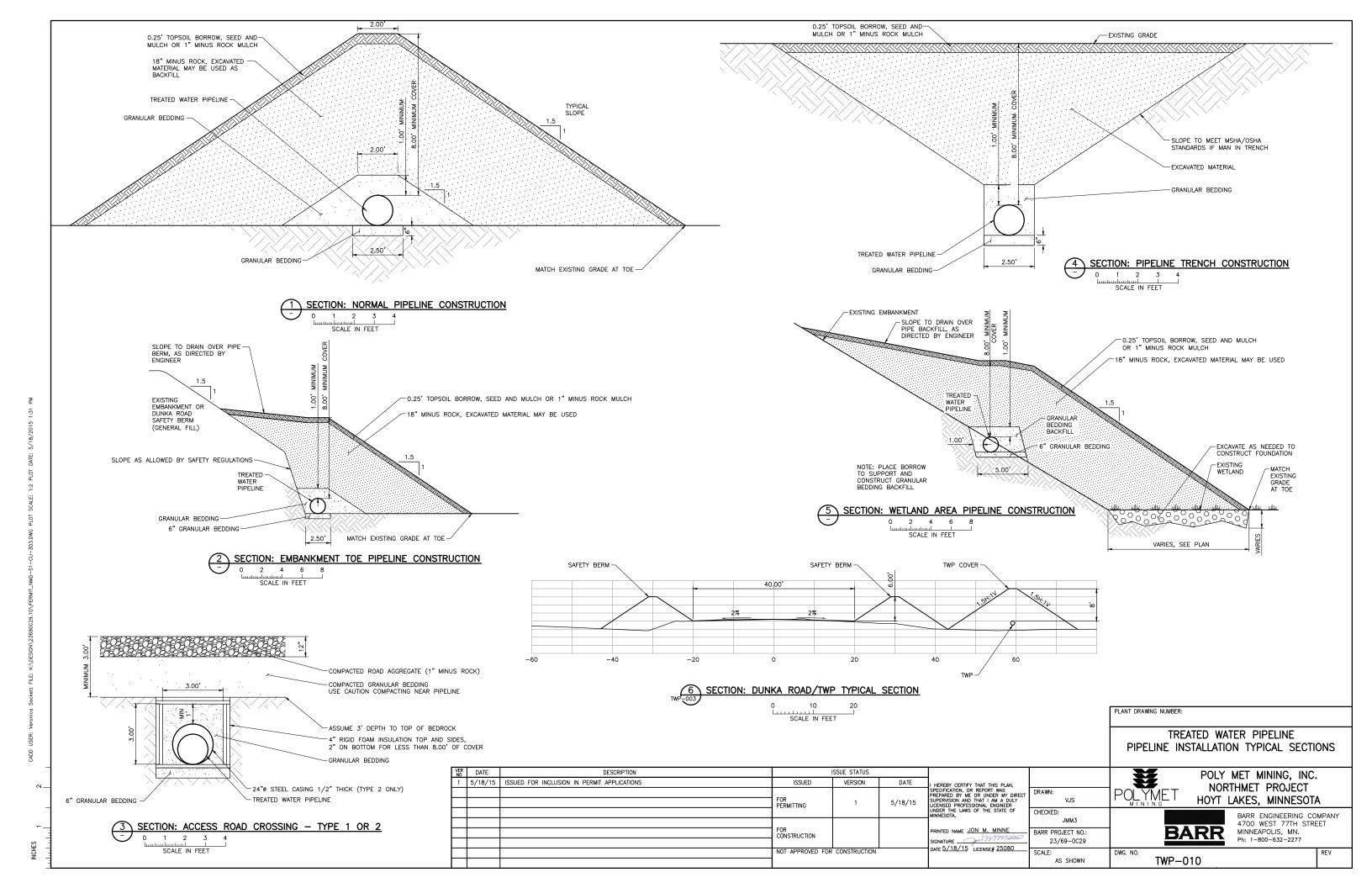
PIPE FROM CONSTRUCTION WATER BASIN

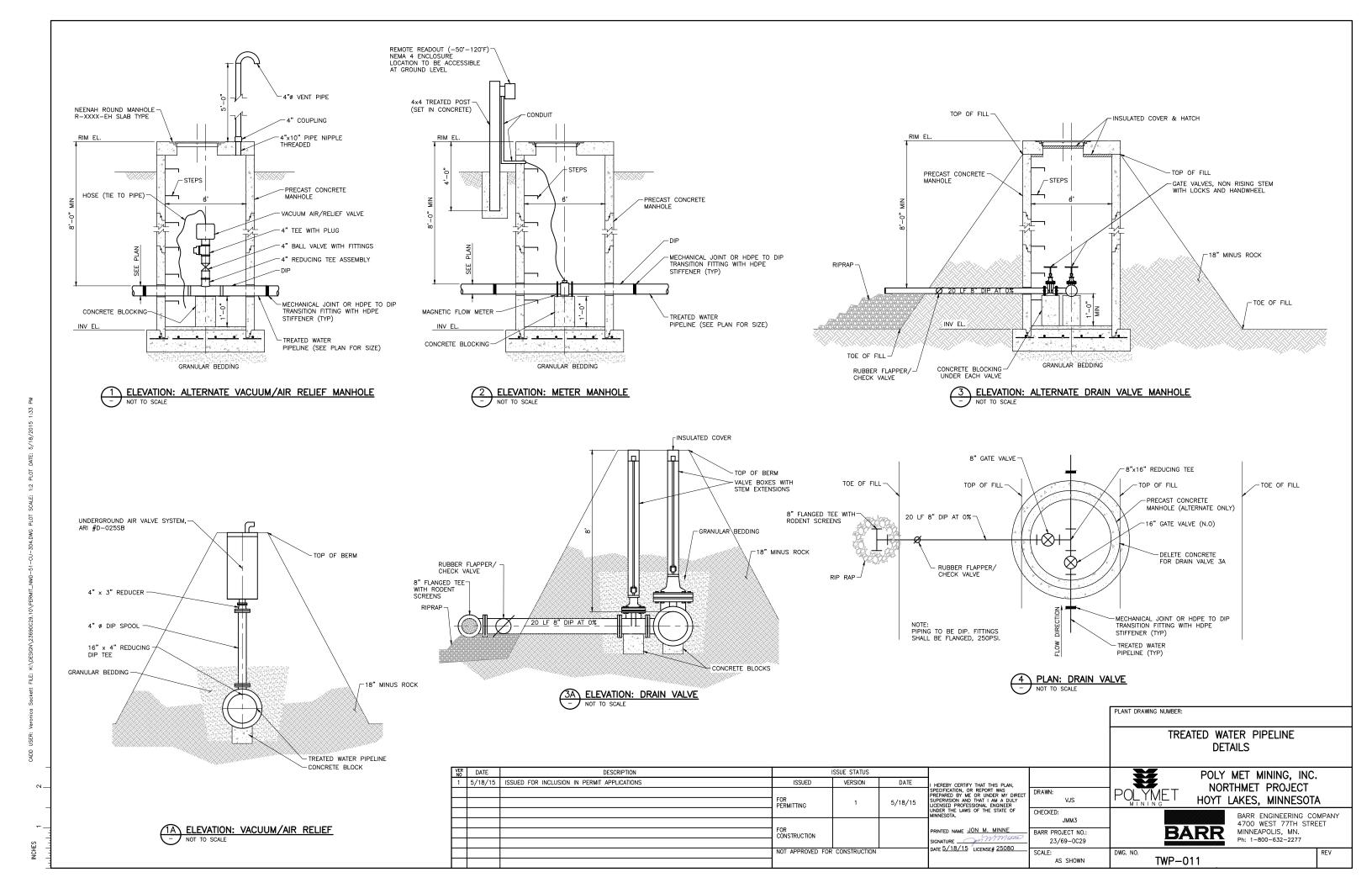
WASTE WATER TREATMENT FACILITY

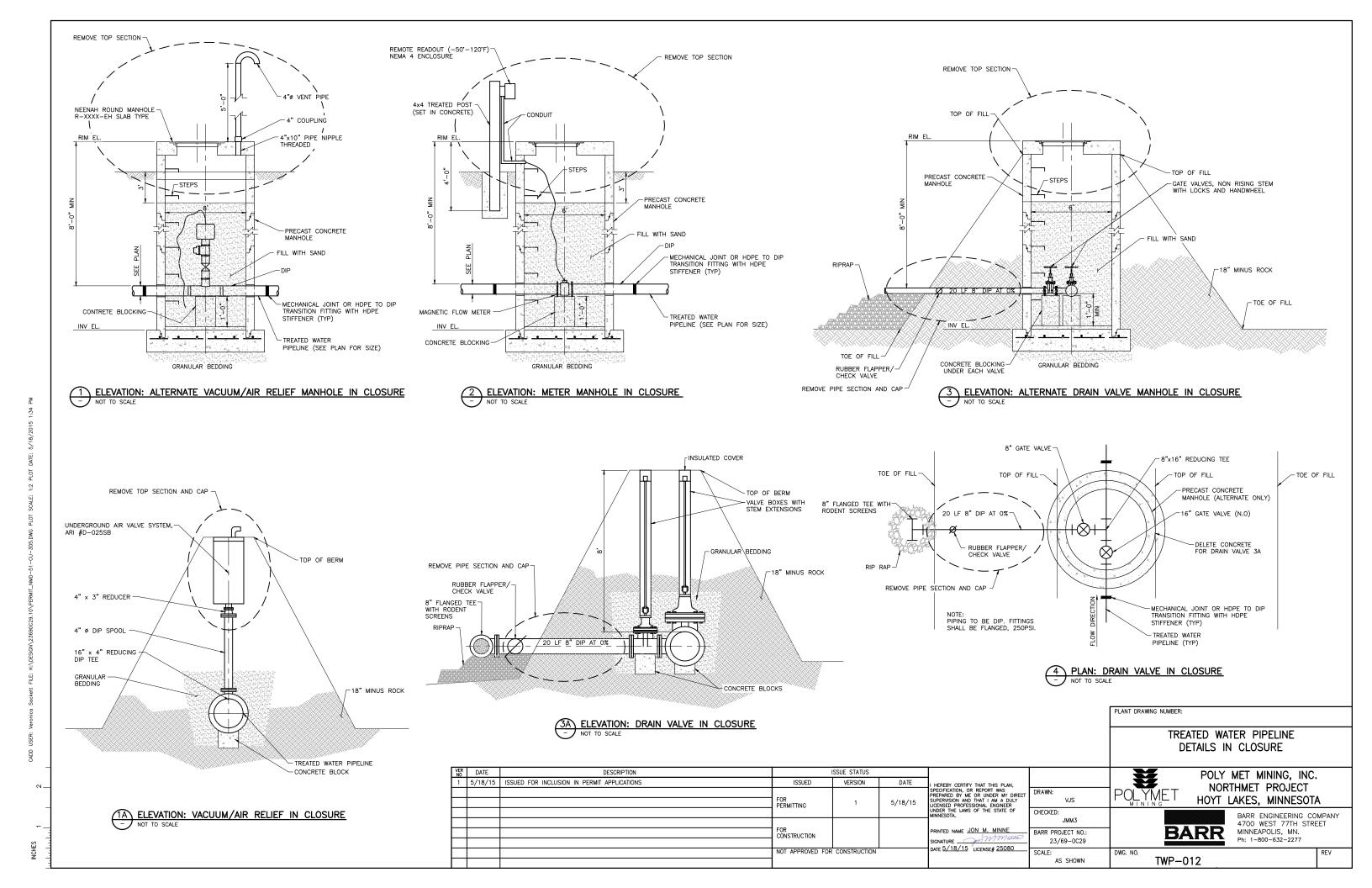
(CPS) SEE SHEET CPS-001

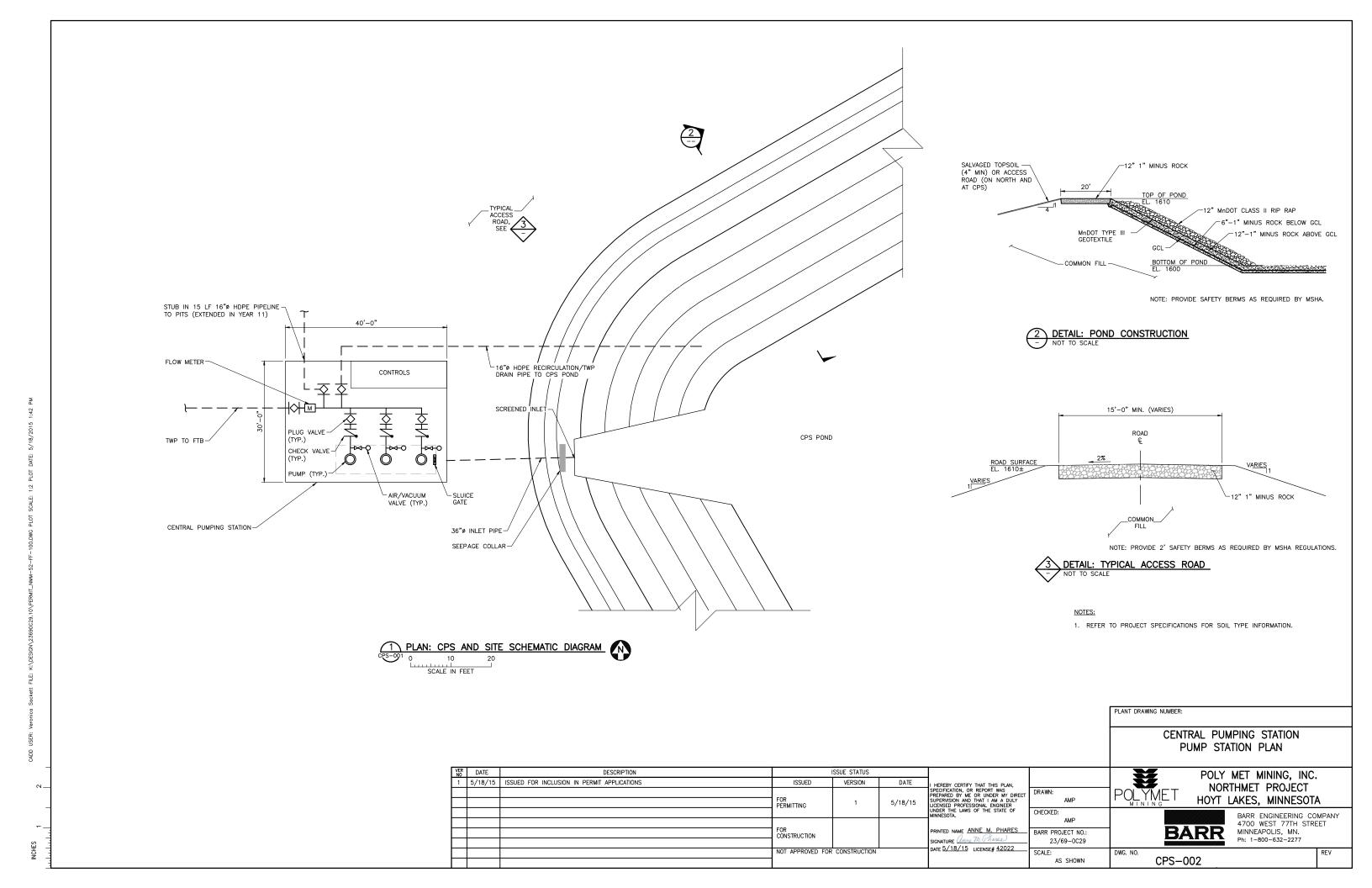
CONNECT TO CPS -DISCHARGE PIPE

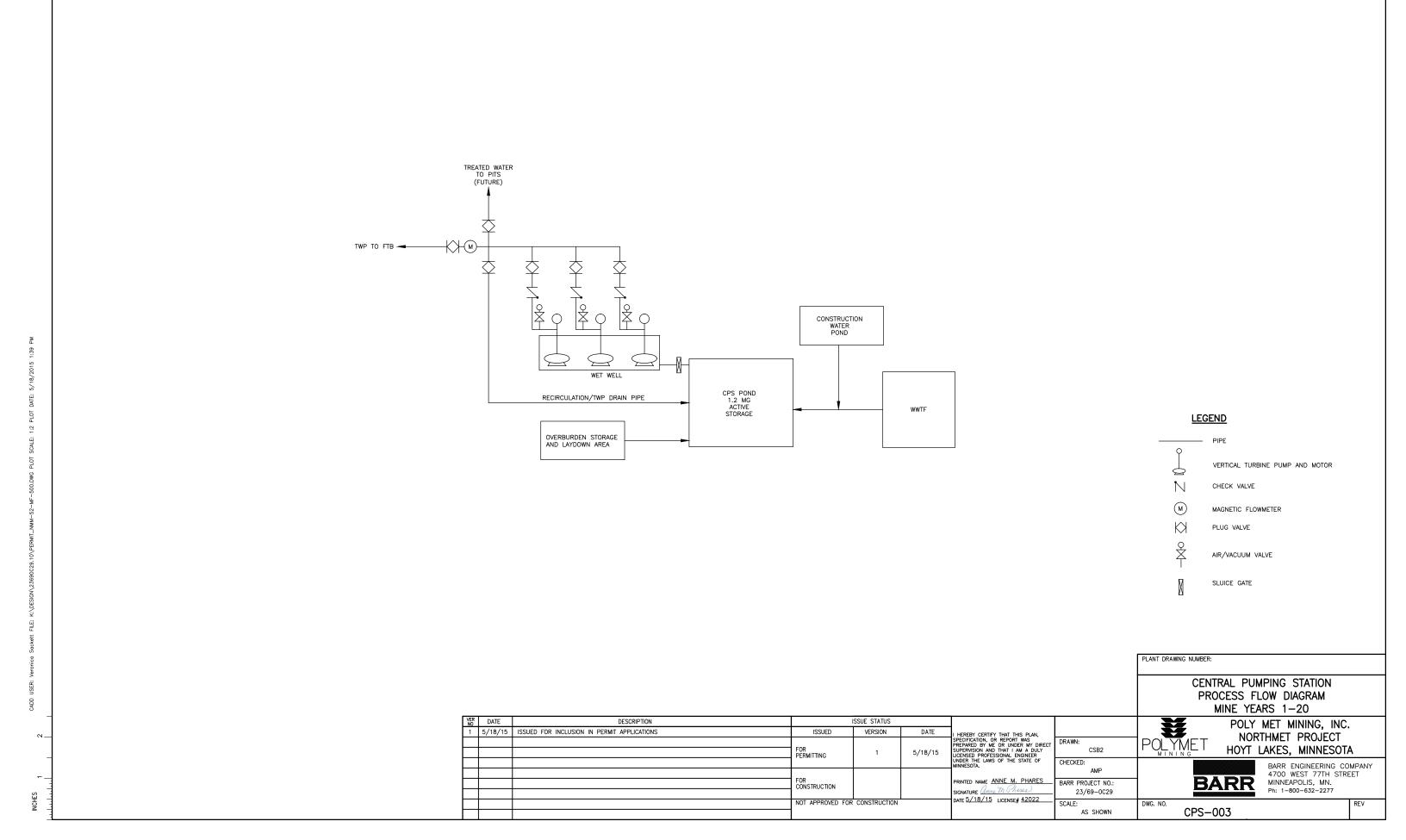
HAUL ROAD CENTERLINE

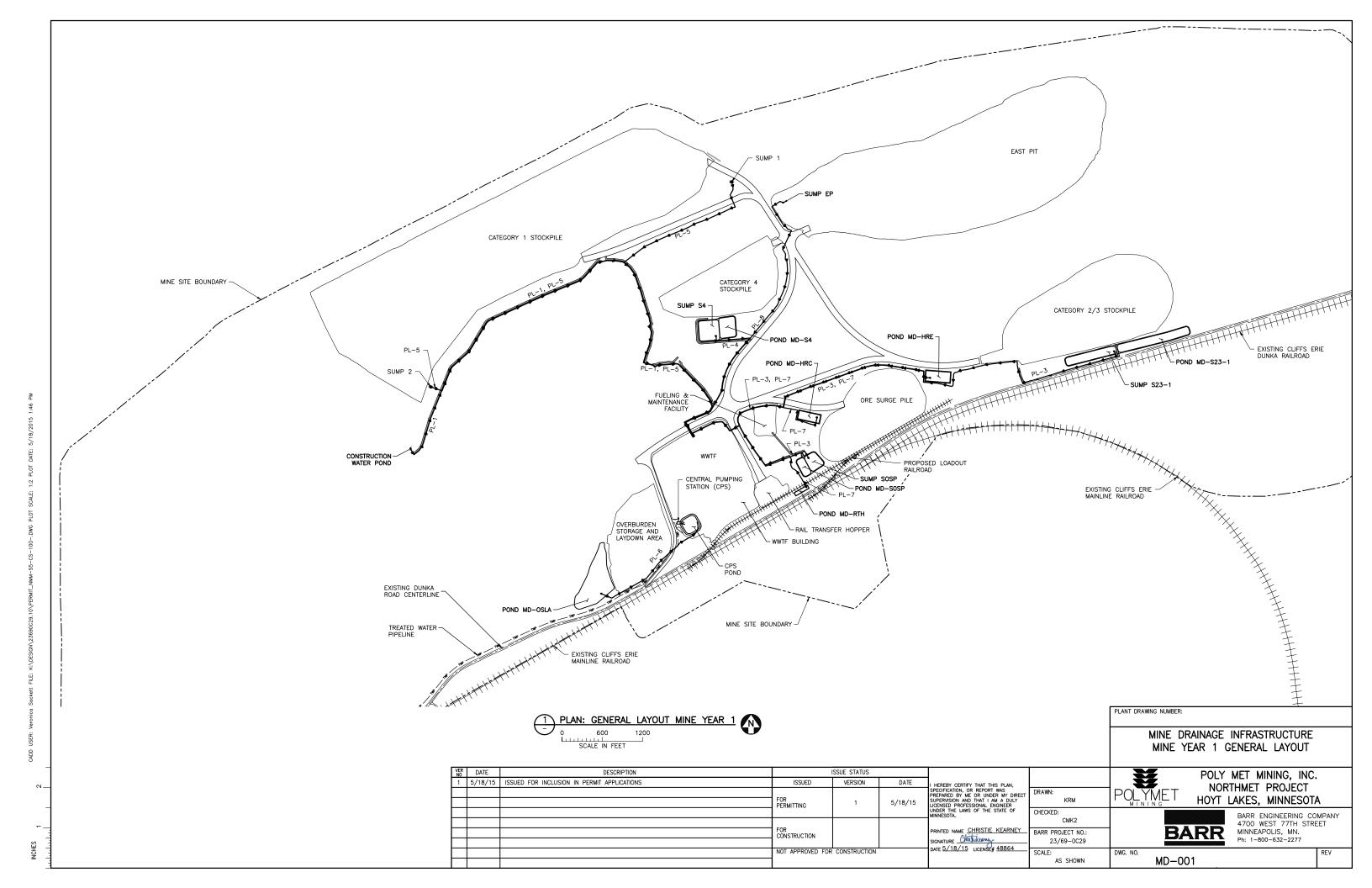


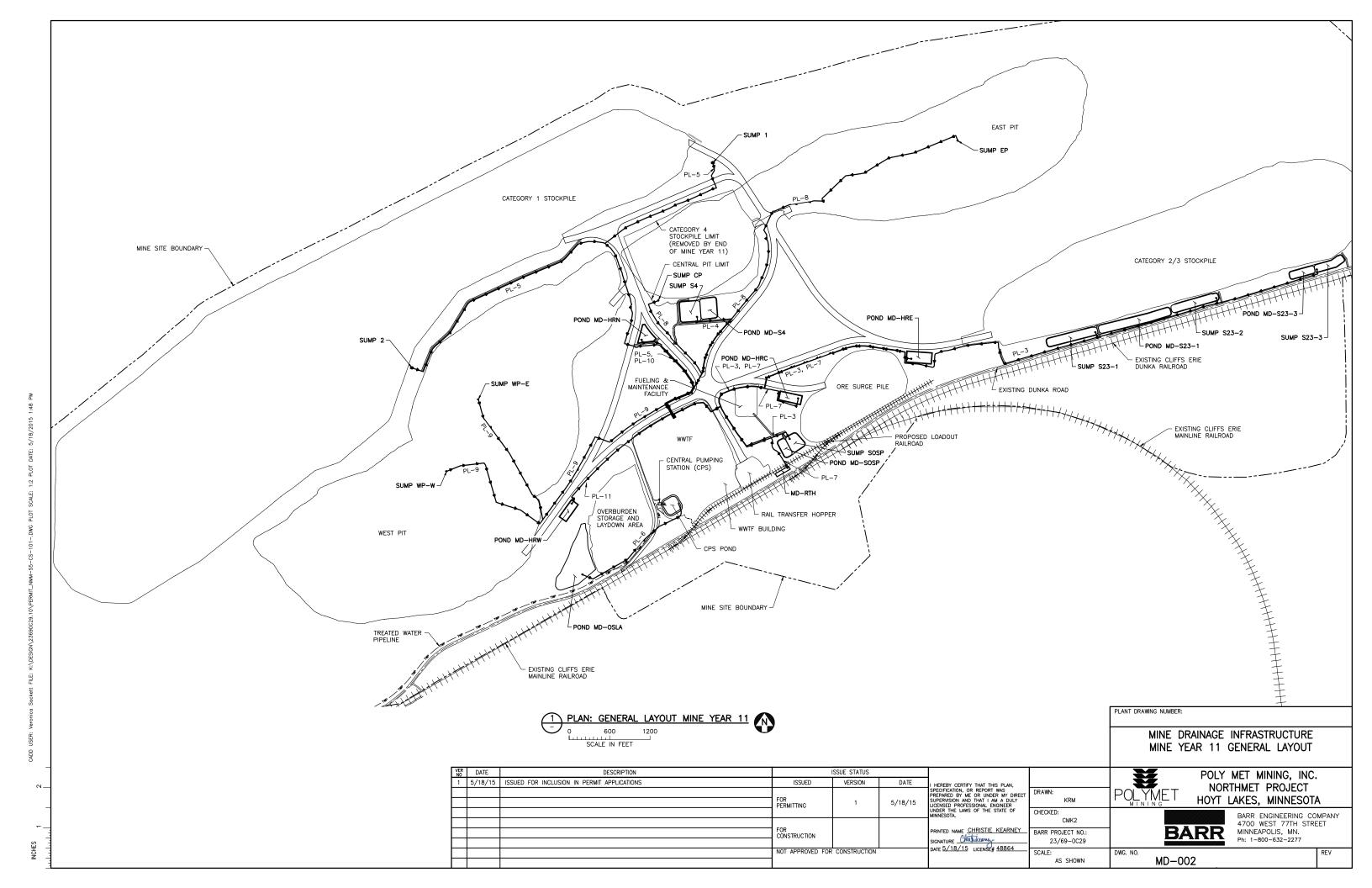


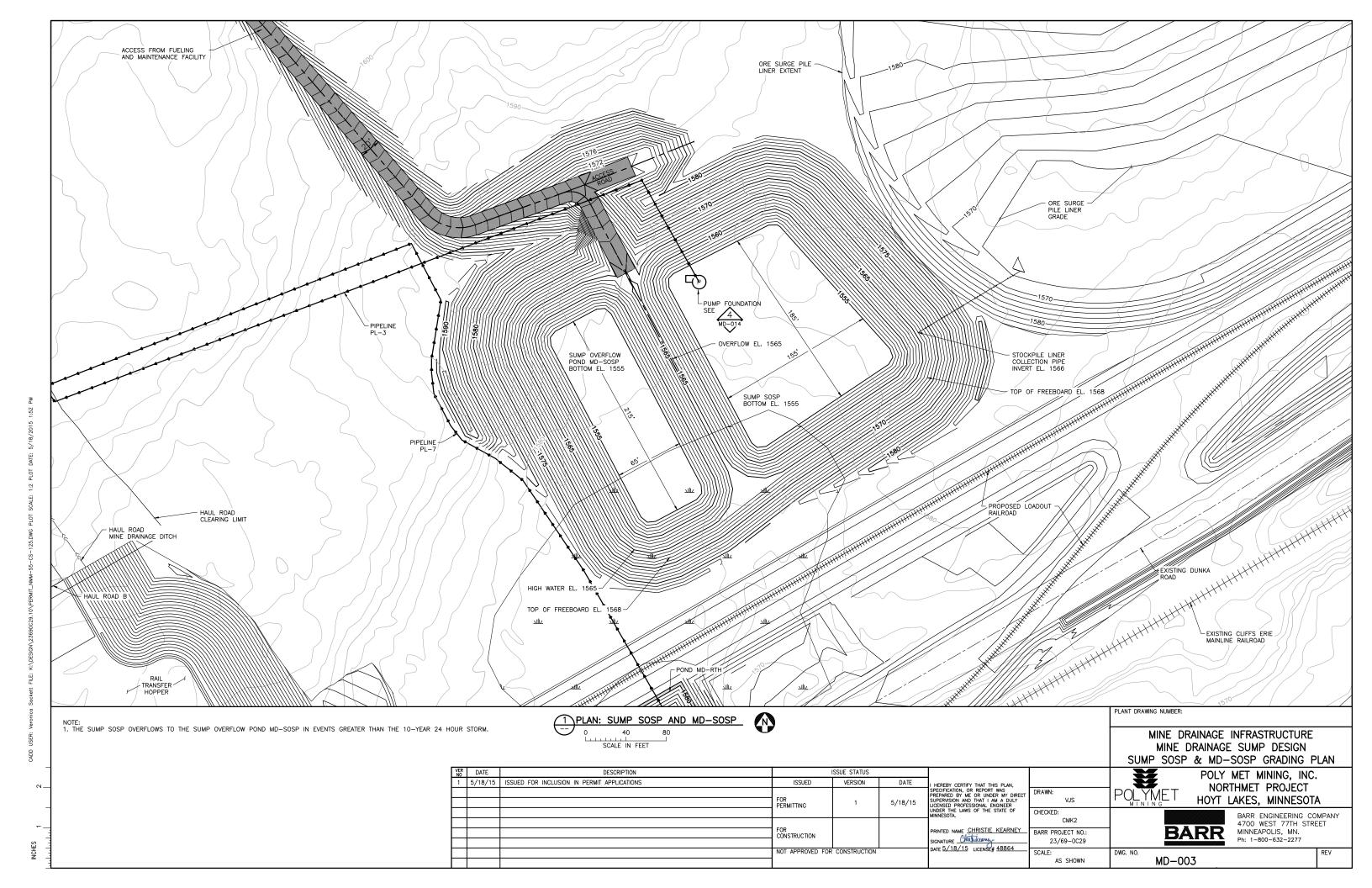


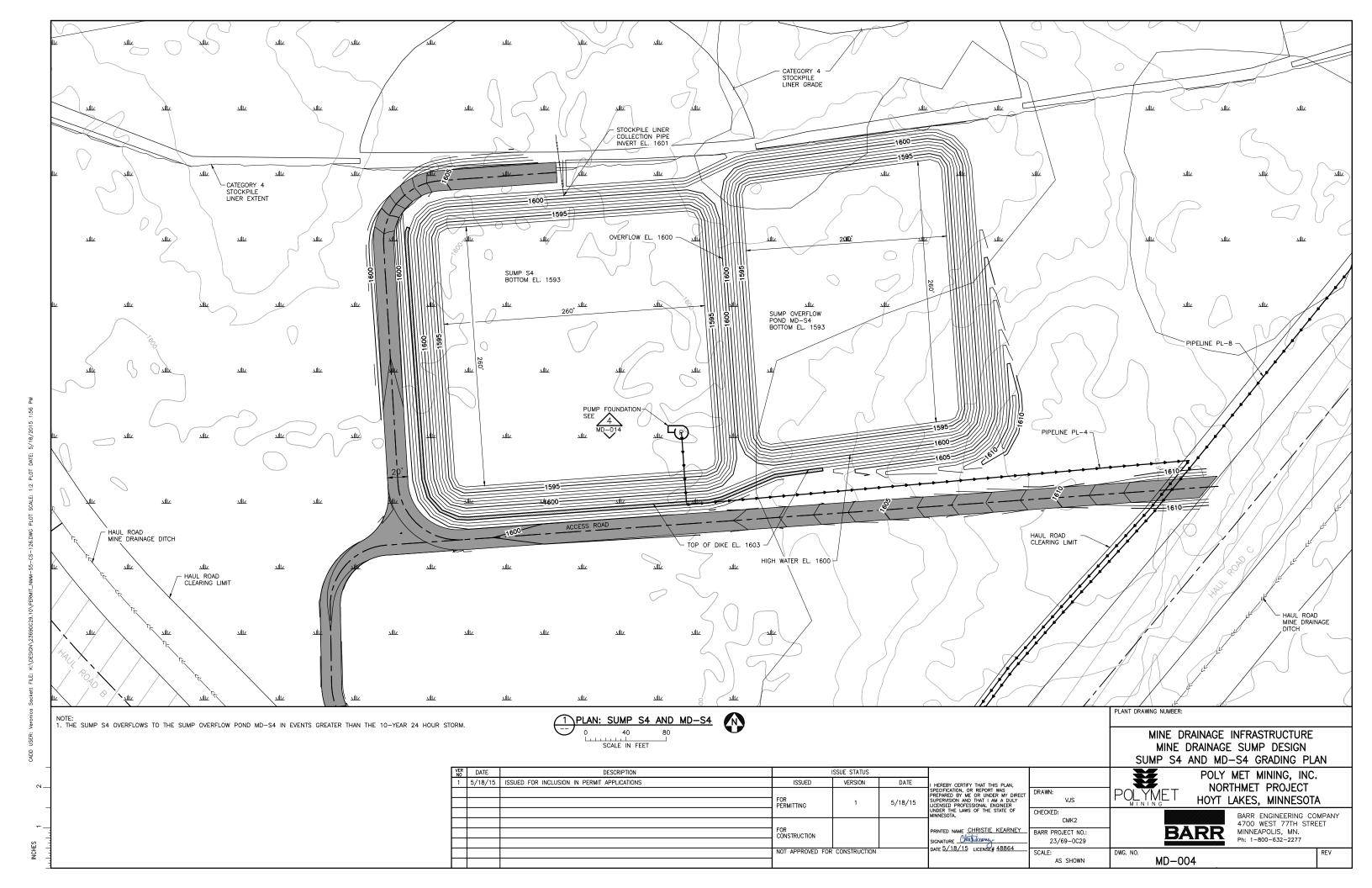


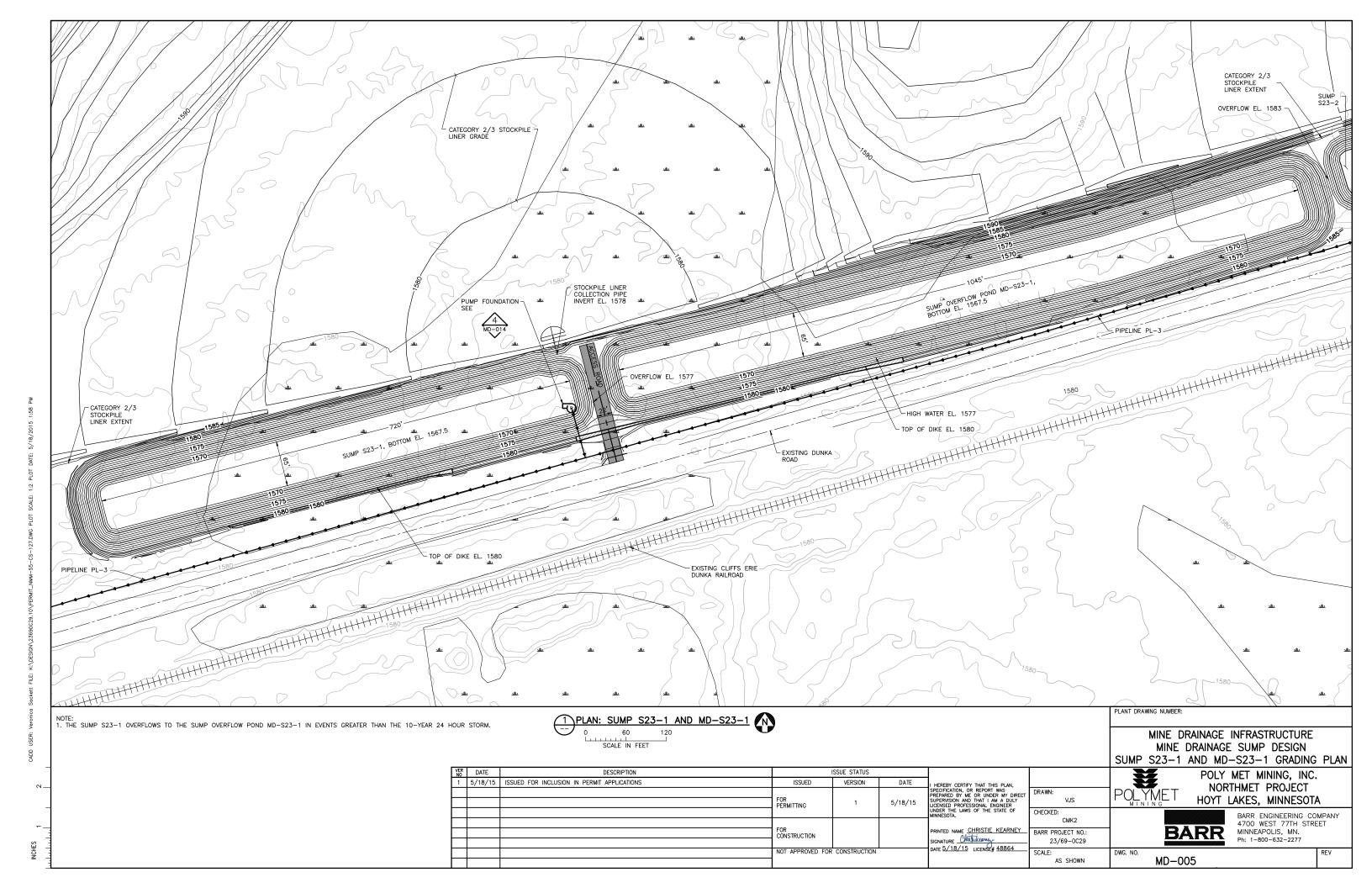


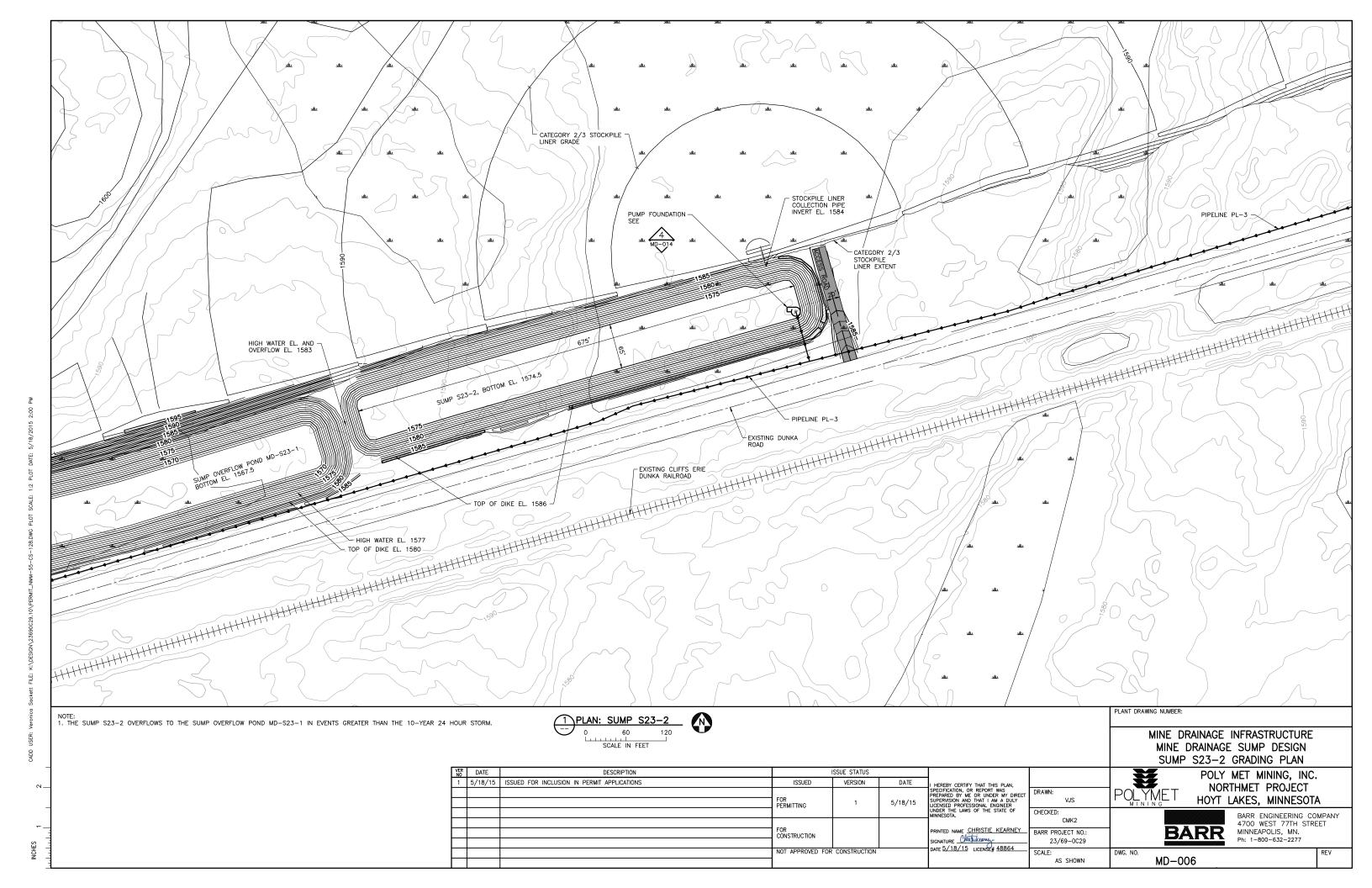


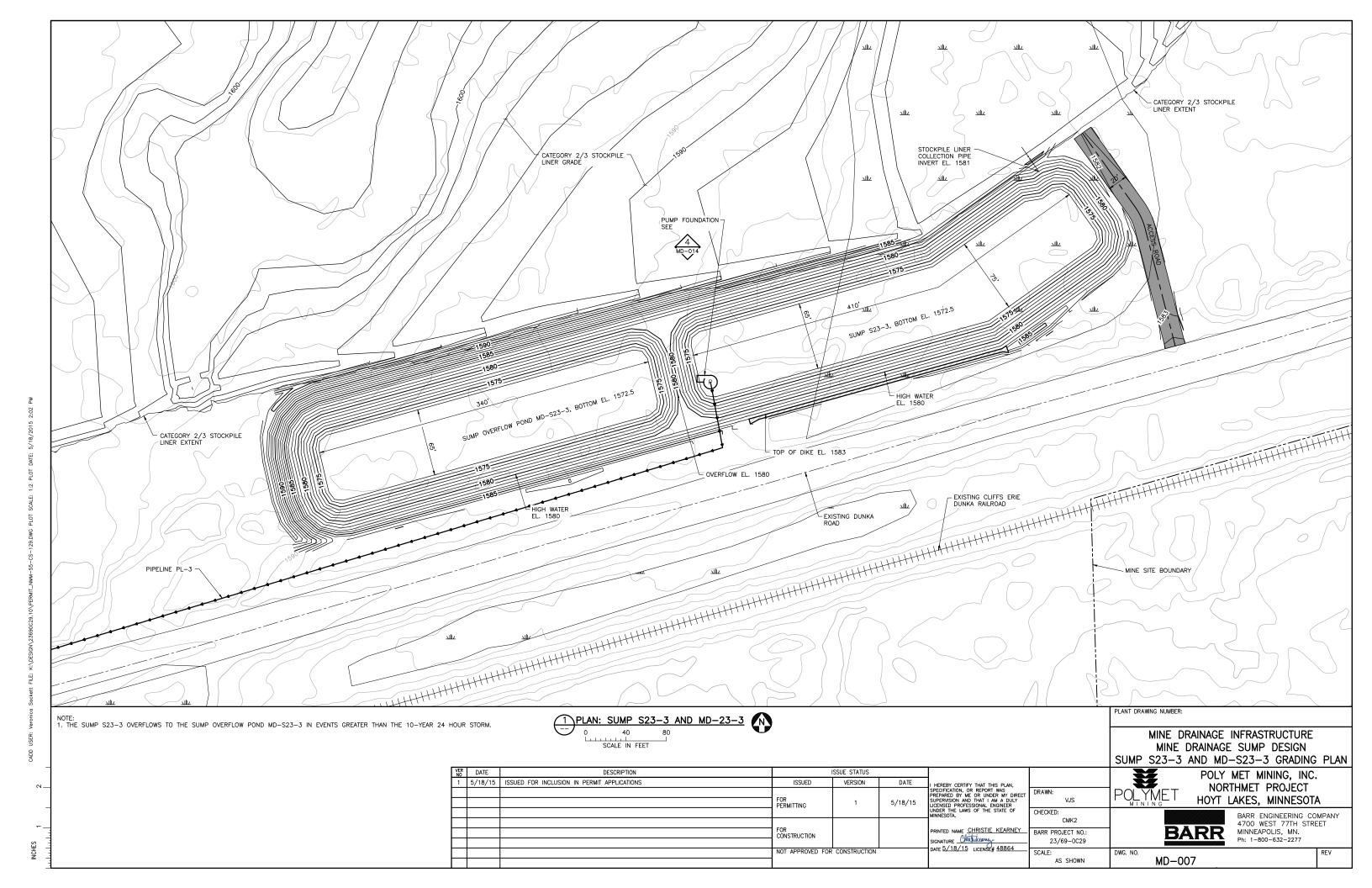


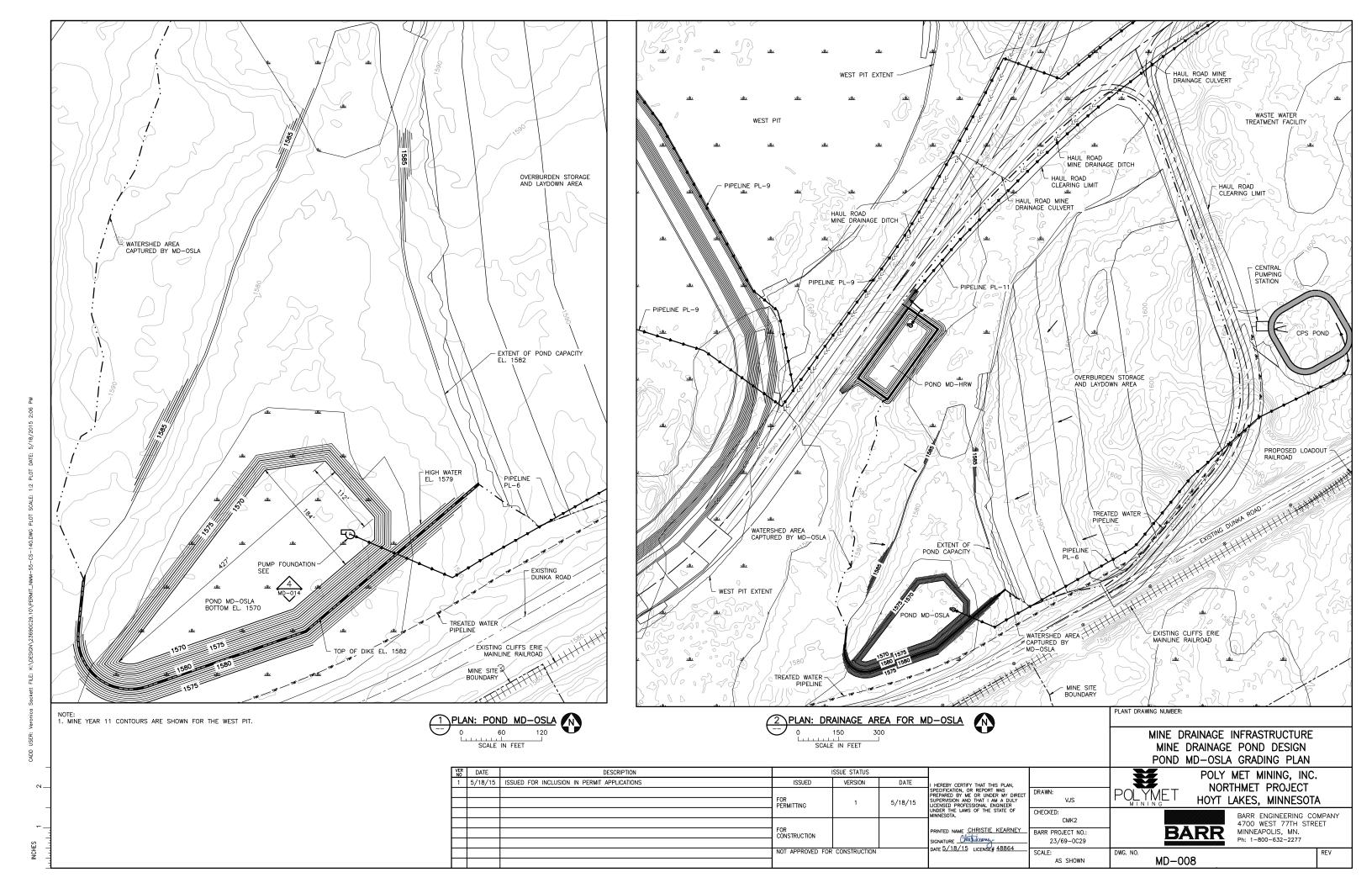


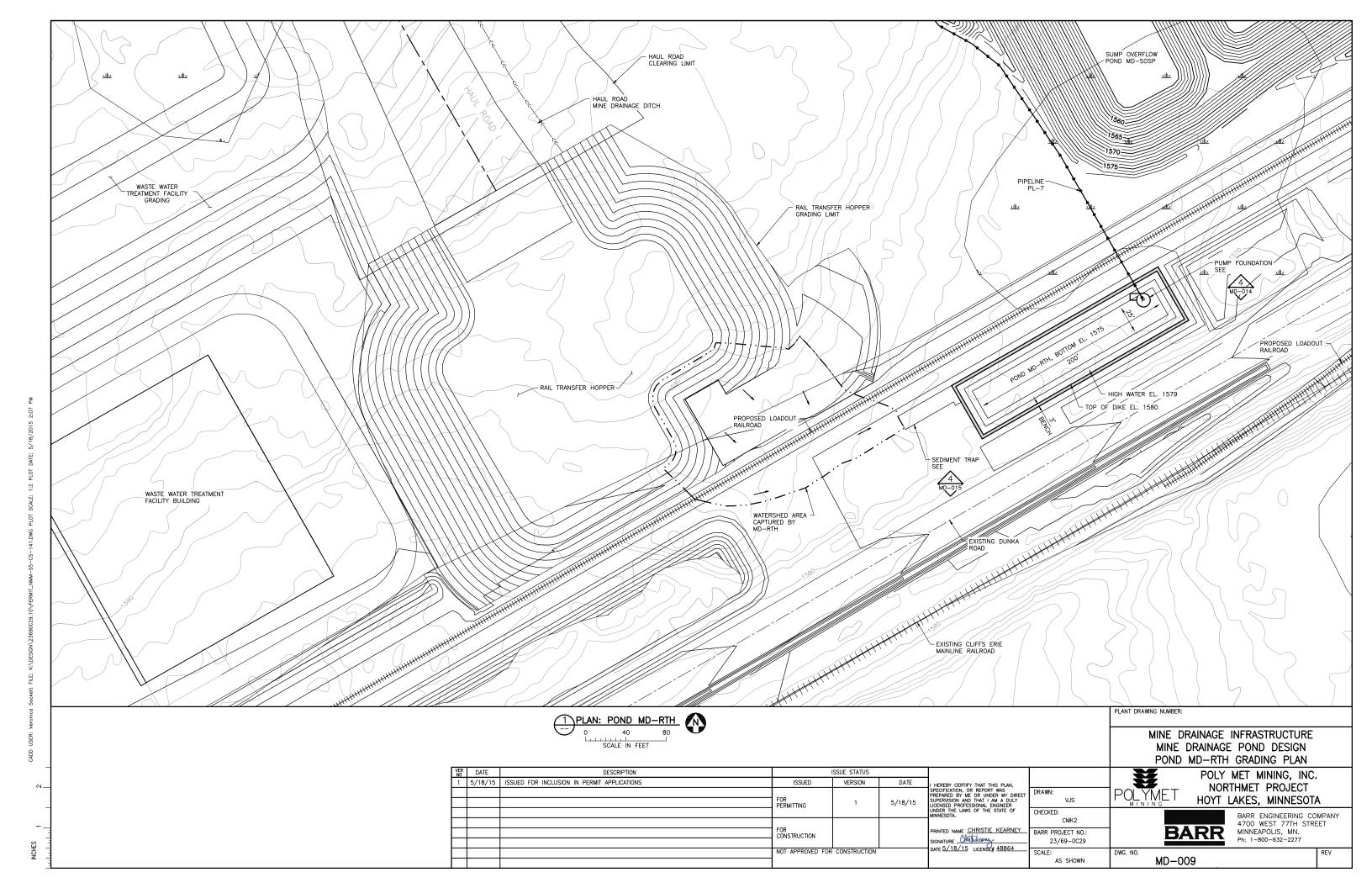


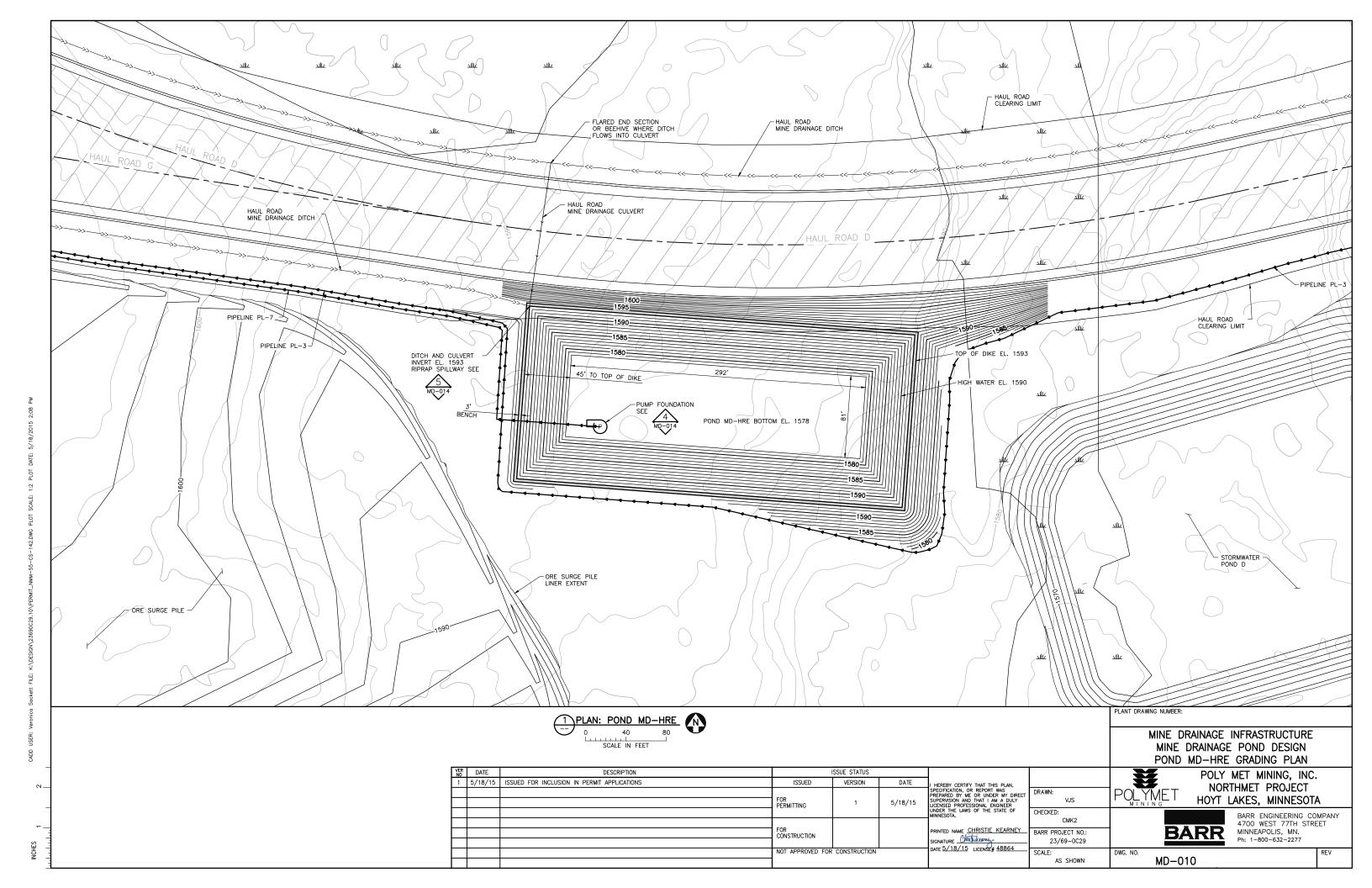


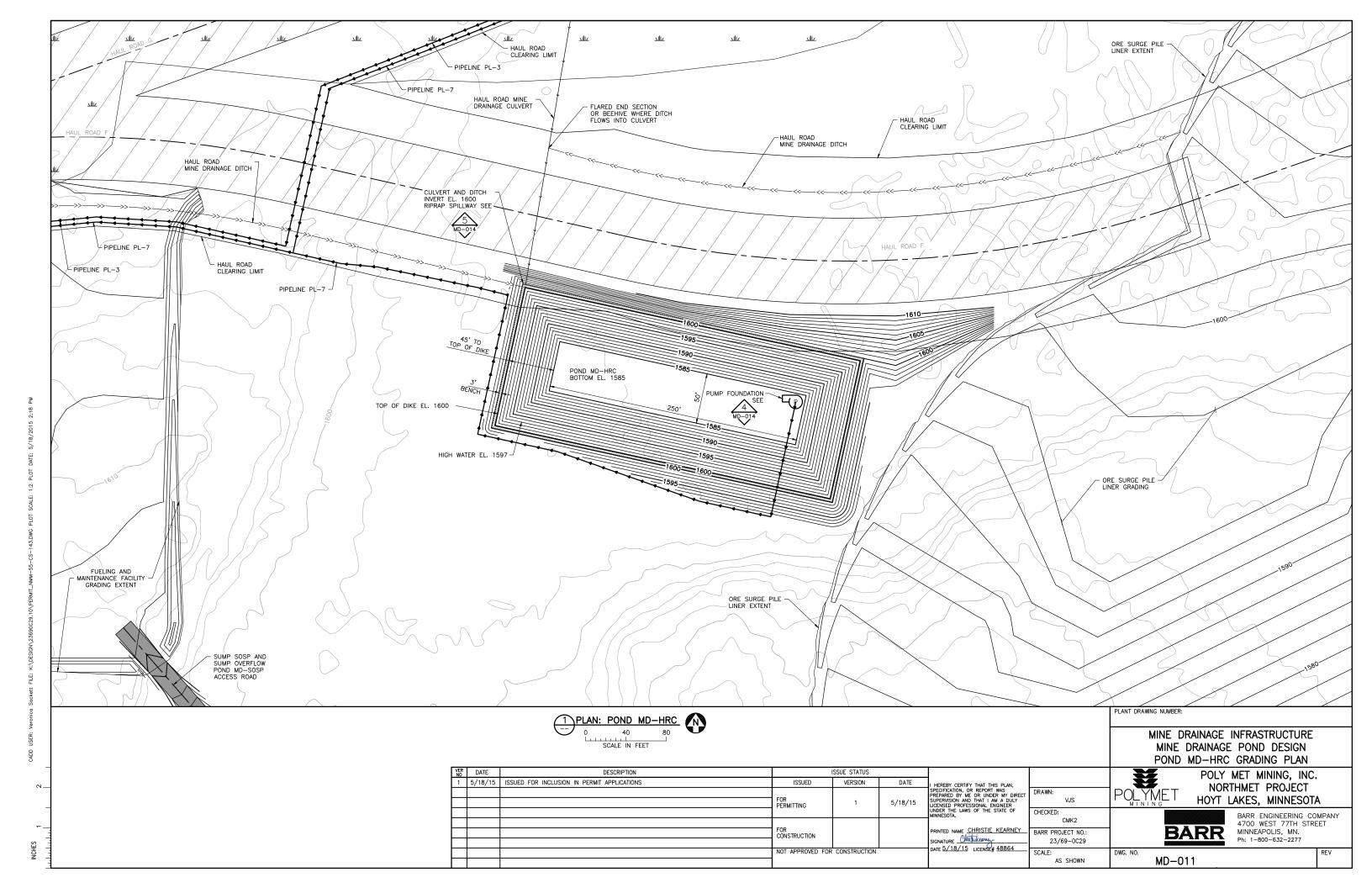


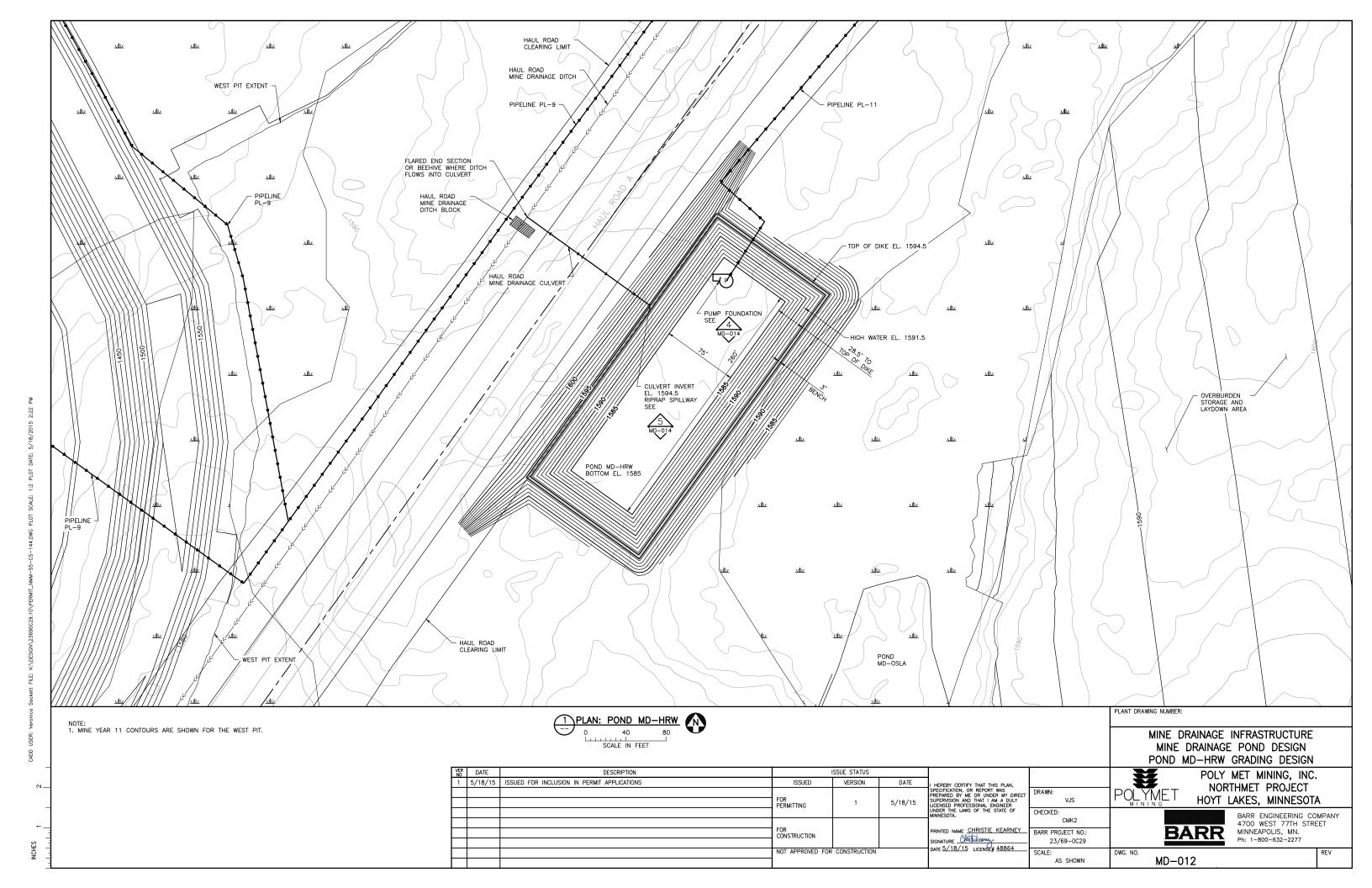


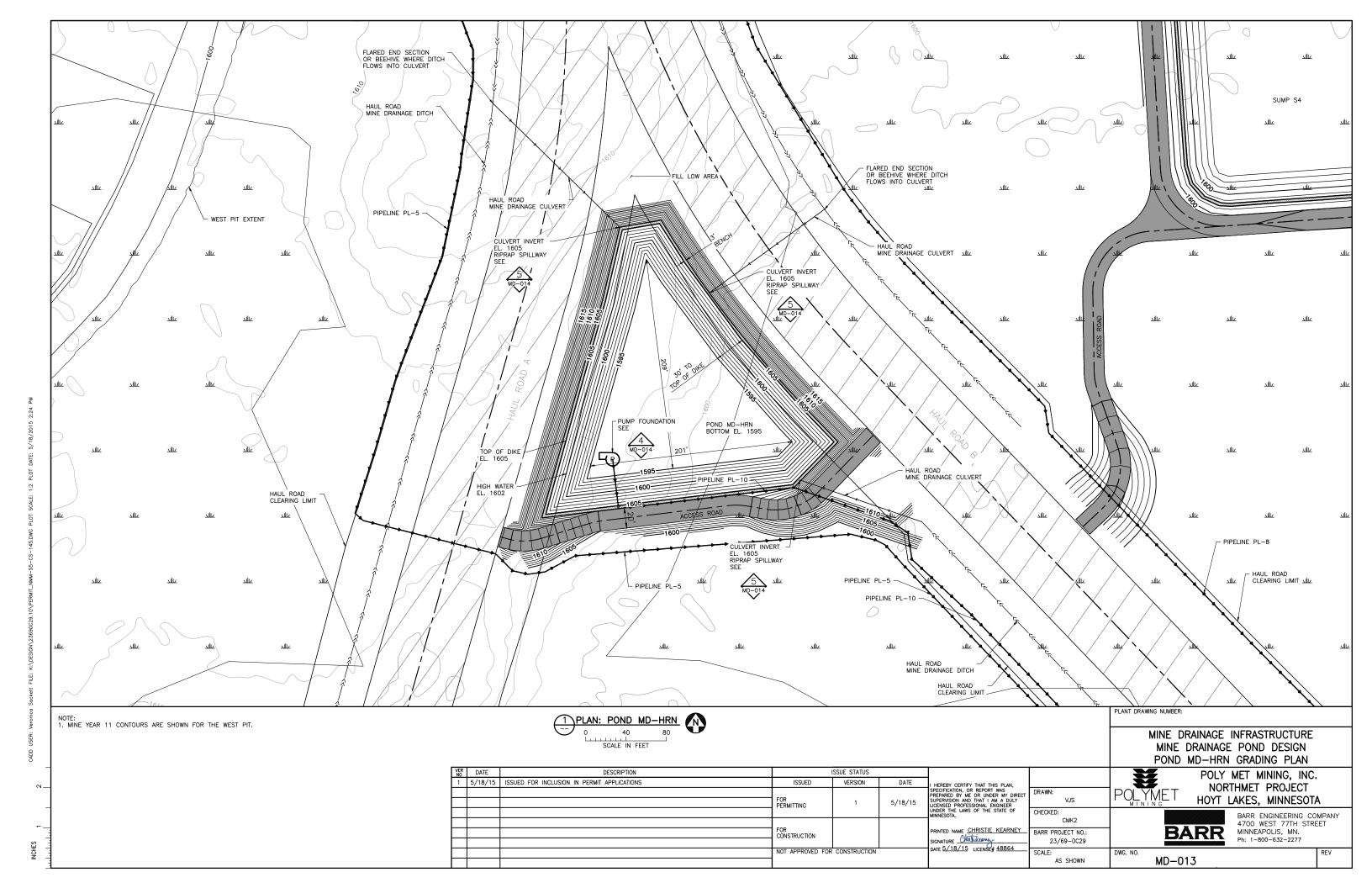


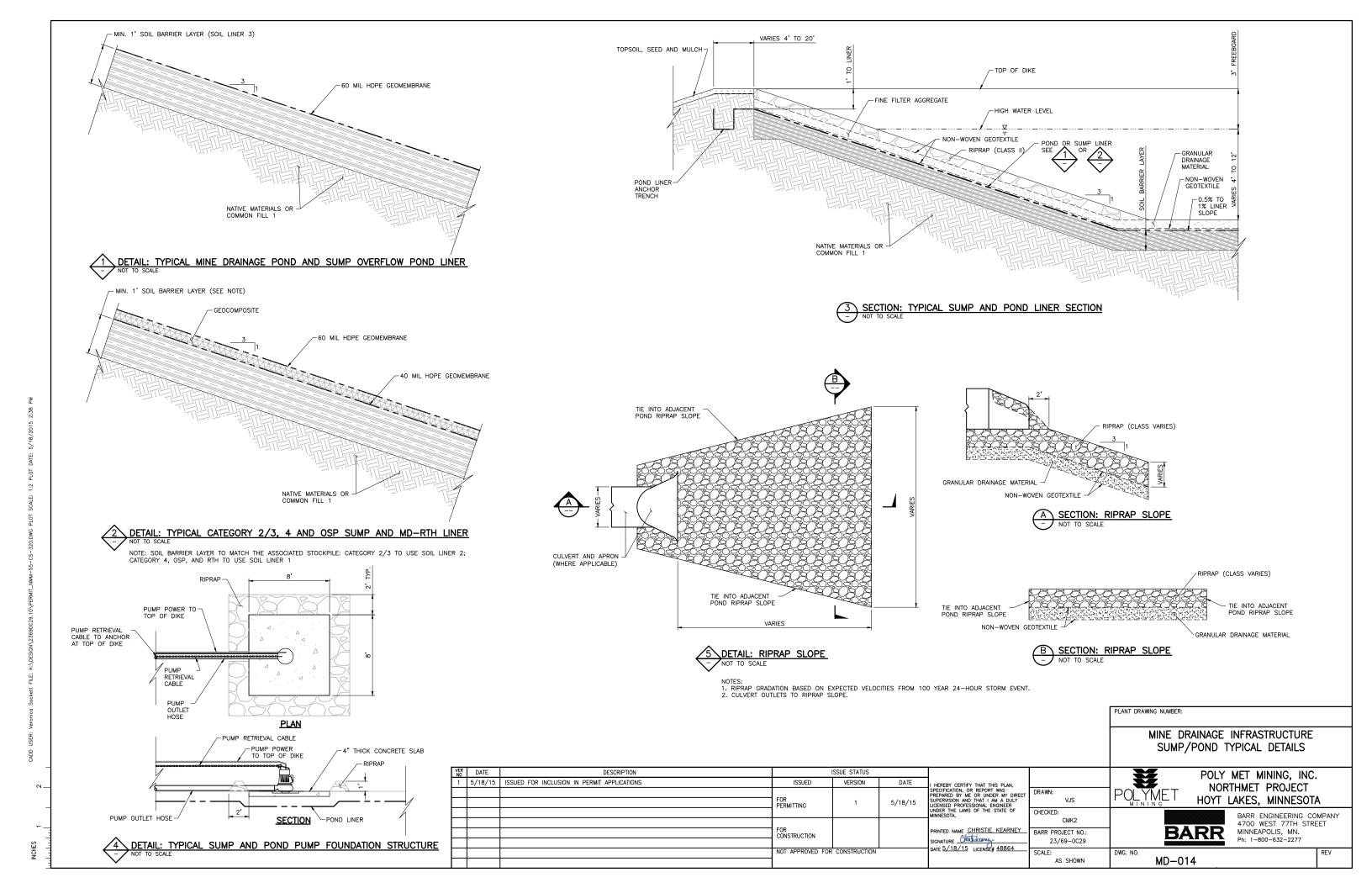


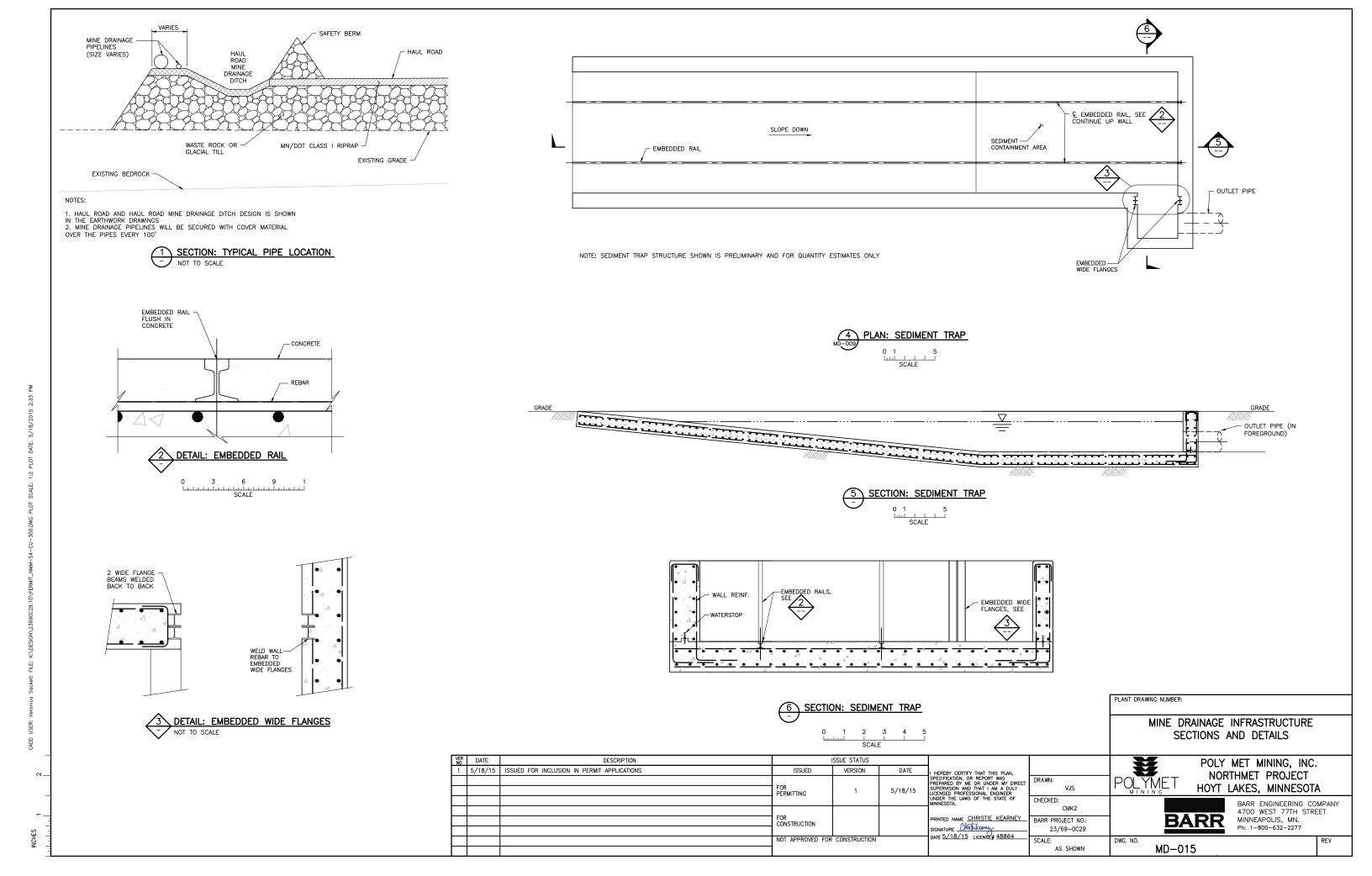


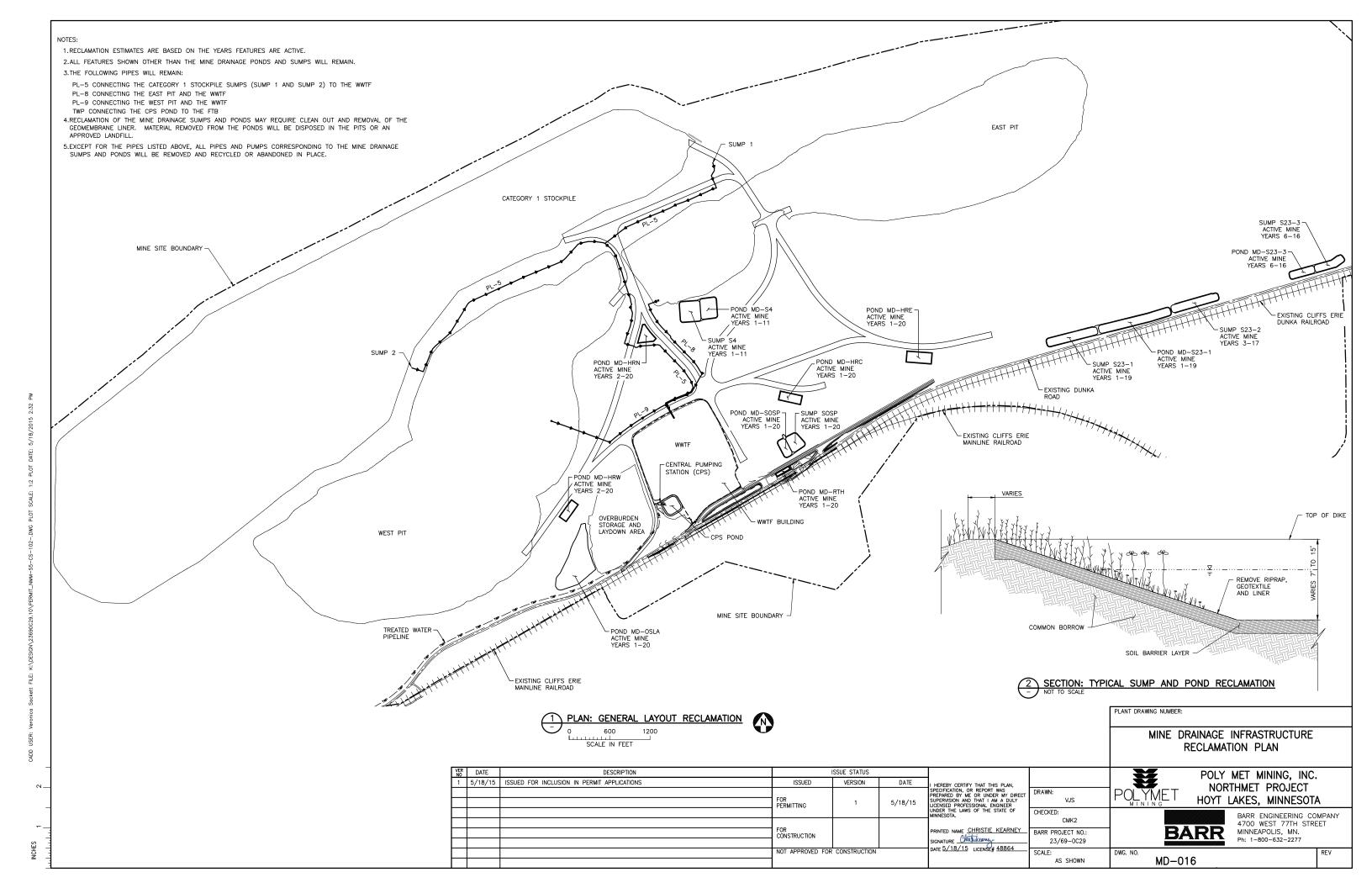






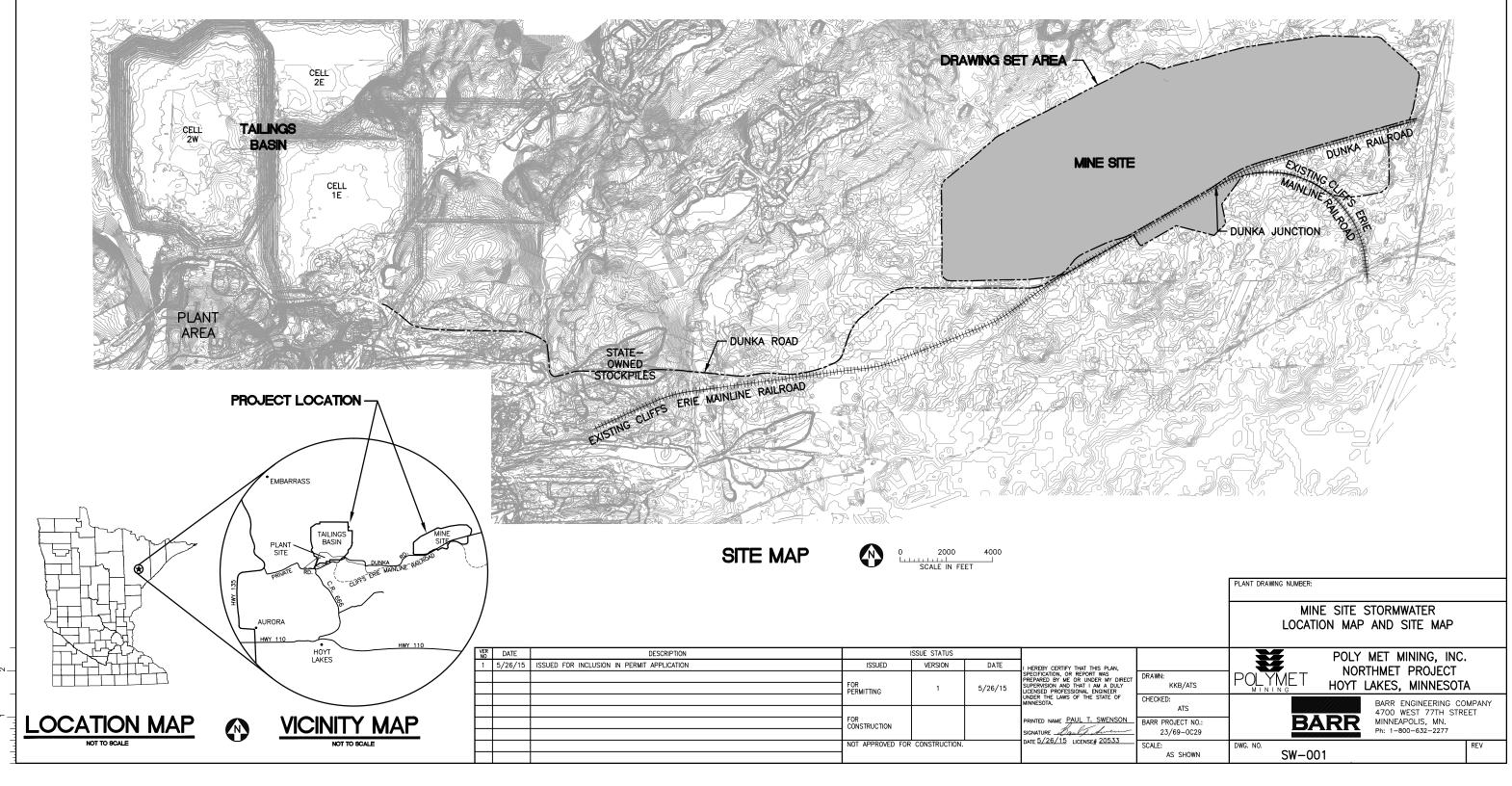






Mine Site Stormwater

POLY MET MINING, INC. NORTHMET PROJECT PERMIT APPLICATION SUPPORT DRAWINGS MINE SITE STORMWATER HOYT LAKES, MINNESOTA



---1000----

----- WATER EDGE/CREEK CENTER LINE

EXISTING ROAD

----R/W--- RIGHT OF WAY

---- MINE SITE BOUNDARY

EXISTING STRUCTURES

- PROPERTY LINE

WETLAND BOUNDARY

 $-\!\!\!-\!\!\!-$ OE $-\!\!\!\!-\!\!\!-$ EXISTING OVERHEAD ELECTRIC

--- UE --- EXISTING UNDERGROUND ELECTRIC

> EXISTING CULVERT

PROPOSED MINE DRAINAGE CULVERT

PROPOSED CONTOUR - MAJOR PROPOSED CONTOUR - MINOR

PROPOSED ACCESS ROADS

PROPOSED STORMWATER DRAIN

SURFACE DRAINAGE

NOTES

COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.

2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL (MSL), NAVD88.

3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON

4. CULVERT DIMENSIONS ARE PRELIMINARY. FINAL DIMENSIONS SHALL BE DETERMINED DURING FINAL DESIGN.

5. THE BEDROCK PROFILES SHOWN ON THESE DRAWINGS REPRESENT THE BEST AVAILABLE INFORMATION FOR PLANNING PURPOSES. THE BEDROCK SURFACE FROM WHICH THE PROFILES ARE EXTRACTED IS A THREE—DIMENSIONAL, MODELED SURFACE THAT RESULTED FROM DEDUCTING THE DEPTH TO BEDROCK IDENTIFIED ON LOGS OF BORINGS CONDUCTED AT THE MINE SITE FROM THE LIDAR TOPOGRAPHIC GROUND SURFACE MODEL. THE RESULTING DATA WAS THEN MODELED IN GIS SOFTWARE TO DEVELOP A THREE—DIMENSIONAL BEDROCK SURFACE. THE PROFILES SHOW SIGNIFICANT DETAIL IN LOCAL ELEVATIONS, WHICH MAY OR MAY NOT ACTUALLY EXIST. THE BEDROCK SURFACE PROFILES SHOULD BE TAKEN AS REPRESENTATIVE, BUT NOT NECESSARILY PRECISE.

ABBREVIATIONS

CATEGORY 1 WASTE ROCK STOCKPILE
CATEGORY 2/3 WASTE ROCK STOCKPILE
CENTERLINE
CENTRAL PUMPING STATION
THE MEDIAN PARTICLE DIAMETER OF A PARTICLESIZE
DISTRIBUTION; THE SIZE AT WHICH 50% OF THE
PARTICLES IN THE MATERIAL PARTICLE SIZE
DISTRIBUTION CURVE ARE SMALLER
ELEVATION
INVERT CATEGORY 1 STOCKPILE CATEGORY 2/3 STOCKPILE

CL CPS D50

III, IV, V

EL
INV
I, I, I
kV
LF
MP
NWL
RCP
O.C.
OSLA
PVI
SWPPP
TWP INVERI
ROMAN NUMERALS FOR RIPRAP CLASSIFICATION
KILOVOLT
LINEAR FEET
MINNESOTA POWER
NORMAL WATER LEVEL
REINFORCED CONCRETE PIPE
ON CENTER
OVERBURDEN STORAGE AND LANDOWN AREA

ON CENTER
OVERBURDEN STORAGE AND LAYDOWN AREA
POINT OF VERTICAL
STORMWAITER POLLUTION PREVENTION PLAN
TREATED WATER PIPELINE
WASTE WATER TREATMENT FACILITY

WWTF

(E) (W) EAST

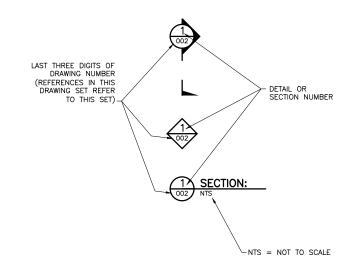
SHEET INDEX

SHEET NO. TITLE

GENERAL DRAWINGS

SW-001 STORMWATER LOCATION MAP AND SITE MAP	
SW-002 STORMWATER LEGEND AND SHEET INDEX	
SW-003 STORMWATER SITE DRAINAGE PLAN MINE YEAR 1	
SW-004 STORMWATER SITE DRAINAGE PLAN MINE YEAR 11	
SW-005 STORMWATER SITE DRAINAGE PLAN MINE YEAR 20	
SW-006 STORMWATER SHEET LOCATION MAP	
SW-007 STORMWATER TYPICAL DIKES AND DITCHES CROSS SECTIONS	
SW-008 STORMWATER SEDIMENTATION POND A GRADING PLAN AND DETAILS	
SW-009 STORMWATER SEDIMENTATION POND B GRADING PLAN AND DETAILS	
SW-010 STORMWATER SEDIMENTATION POND C-EAST GRADING PLAN AND DETAILS	
SW-011 STORMWATER SEDIMENTATION POND C-WEST GRADING PLAN AND DETAILS	
SW-012 STORMWATER SEDIMENTATION POND D GRADING PLAN AND DETAILS	
SW-013 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 10+00N - 38+50N	
SW-014 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 38+50N - 66+50N	
SW-015 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 66+50N - 94+00N	
SW-016 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 94+00N - 122+00N	
SW-017 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 122+00N - 144+00I	
SW-018 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 146+00N - 162+00I	
SW-019 STORMWATER NORTH DIKE AND DITCH PLAN AND PROFILE STATION 162+00N - 183+00I	4
SW-020 STORMWATER SOUTH DIKE AND DITCH PLAN AND PROFILE STATION 10+00S - 22+95S	
SW-021 STORMWATER DITCH B PLAN AND PROFILE STATION 0+00B - 17+50B	
SW-022 STORMWATER DITCH B PLAN AND PROFILE STATION 17+50B - 35+00B	
SW-023 STORMWATER DITCH C(E) PLAN AND PROFILE STATION 0+00C(E) - 19+64C(E)	
SW-024 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 0+00C(W) - 18+00C(W)	
SW-025 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 18+00C(W) - 34+50C(W)	
SW-026 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 35+00C(W) - 55+00C(W)	
SW-027 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 55+00C(W) - 75+00C(W)	
SW-028 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 75+00C(W) - 94+60C(W)	
SW-029 STORMWATER DITCH C(W) PLAN AND PROFILE STATION 95+00C(W) - 124+35C(W)	
SW-030 STORMWATER DITCH D PLAN AND PROFILE STATION 0+00D - 27+00D	
SW-031 STORMWATER DIKES, DITCHES, AND PONDS CLOSURE PLAN	

DRAWING NUMBERING



MINE SITE STORMWATER

PLANT DRAWING NUMBER:

POLYME

LEGEND AND SHEET INDEX

)	DATE	DESCRIPTION	ISSUE STATUS				i
	5/26/15	ISSUED FOR INCLUSION IN PERMIT APPLICATION	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.	
			FOR PERMITTING	1		SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: KKB/ATS
						UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED: ATS
			FOR CONSTRUCTION			PRINTED NAME PAUL T. SWENSON SIGNATURE Baulf Sum	BARR PROJECT NO.: 23/69-0C29
			NOT APPROVED FOR	CONSTRUCTION.		DATE 5/26/15 LICENSE# 20533	SCALE:
							AS SHOWN

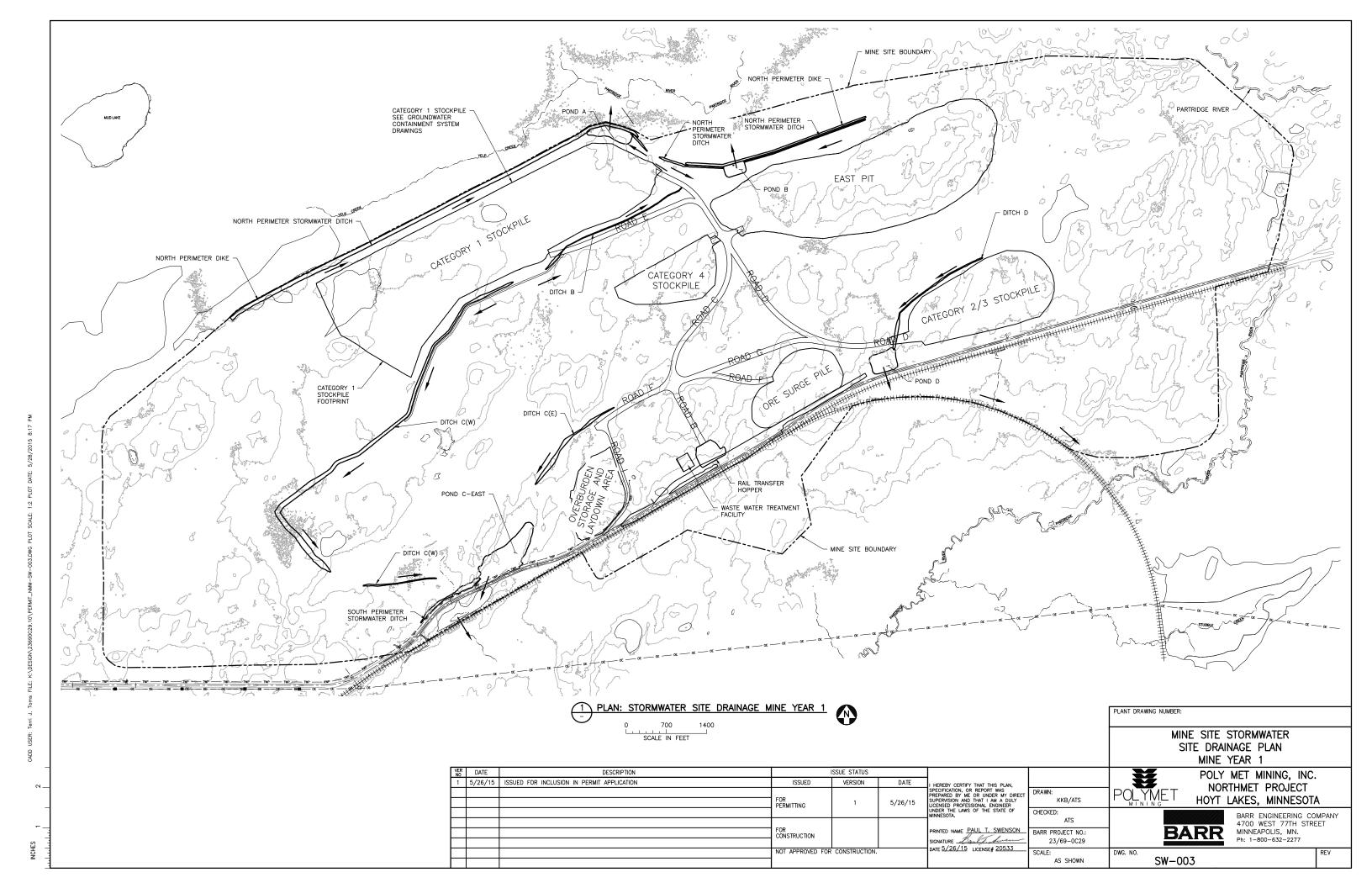
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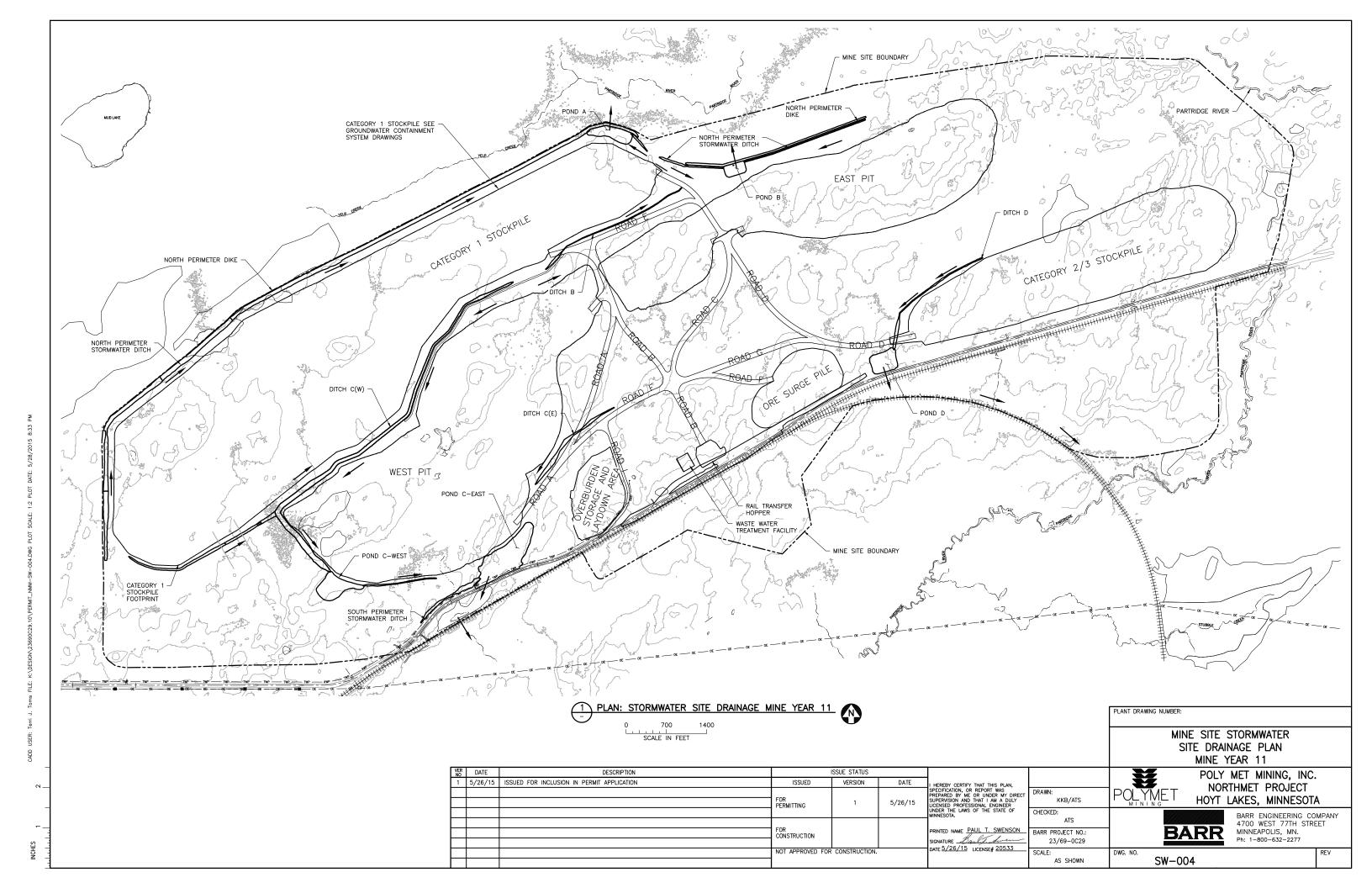
POLY MET MINING, INC. NORTHMET PROJECT

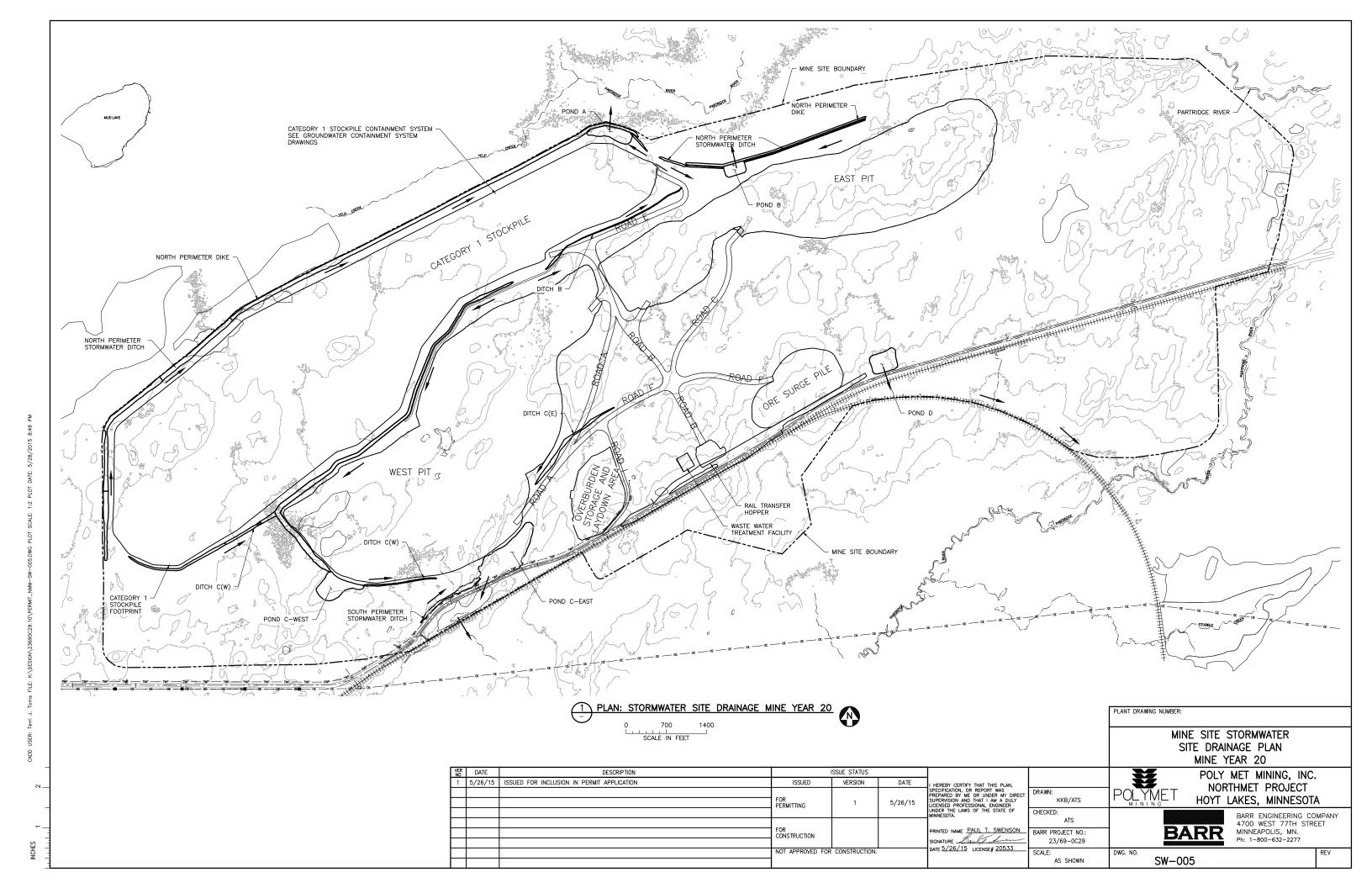
HOYT LAKES, MINNESOTA

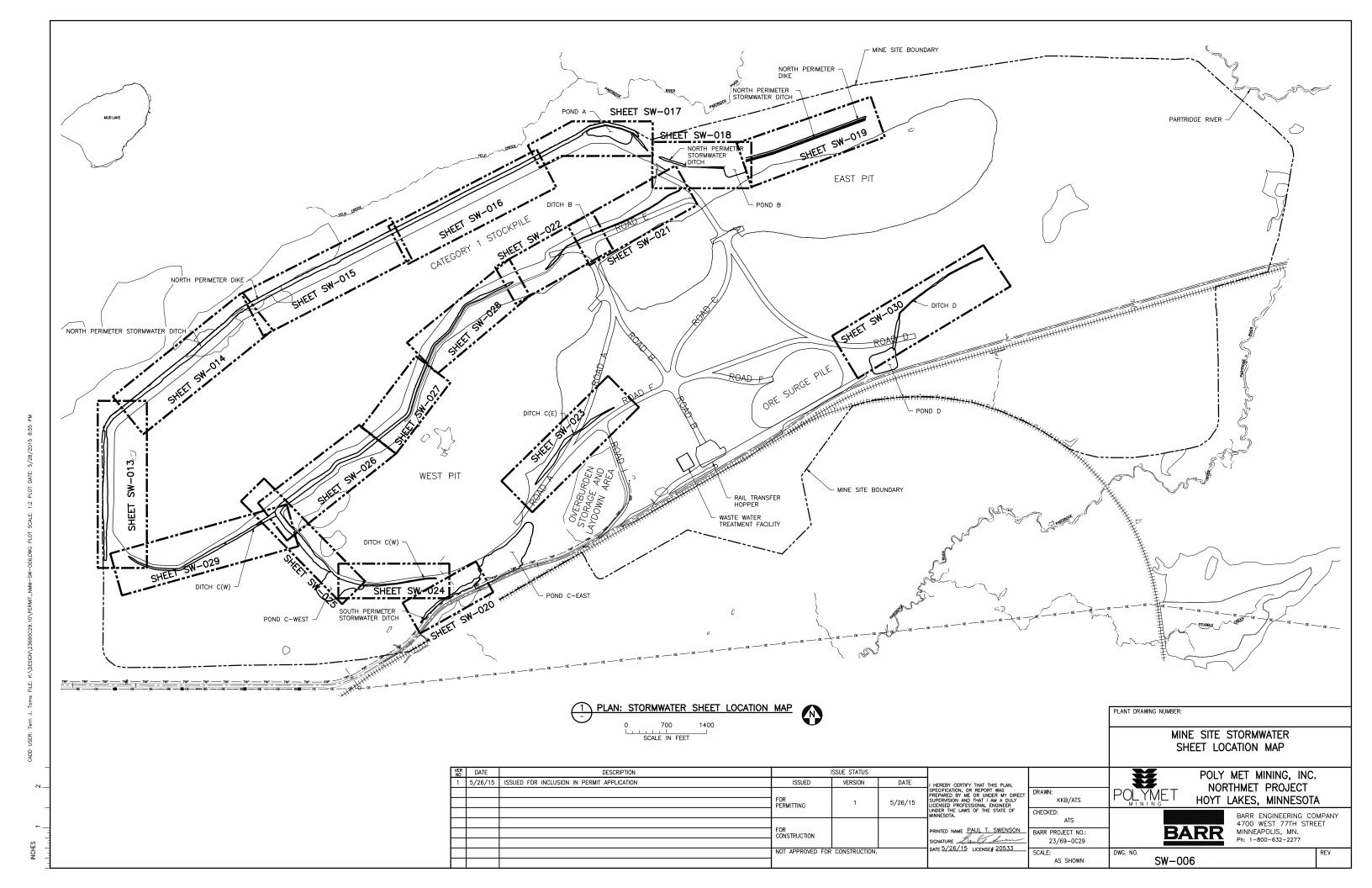
Ph: 1-800-632-2277

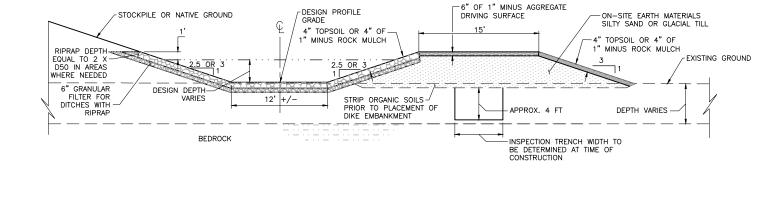
SW-002

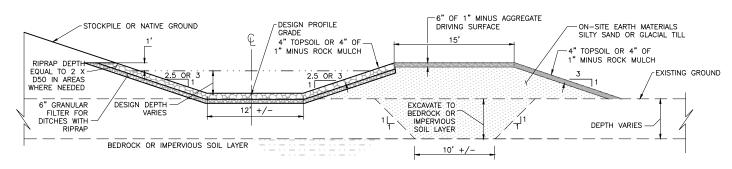






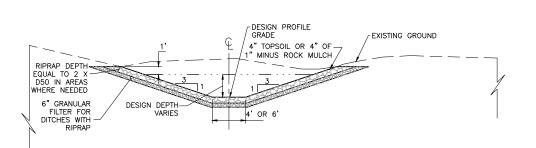






SECTION: TYPICAL PERIMETER DIKE AND DITCH WITHOUT SEEPAGE CUTOFF TRENCH





3 SECTION: TYPICAL INTERIOR DITCH

SCALE IN FEET

- 1. DITCHES NOT REQUIRING RIPRAP WILL BE CONSTRUCTED WITH NATIVE SOILS AND EITHER 4" TOPSOIL OR 4" OF 1" MINUS ROCK MULCH TO DESIGN PROFILE GRADE.
- 2. RESTORE ALL DISTURBED AREAS NOT STABILIZED WITH RIPRAP IN ACCORDANCE WITH THE SWPPP.
- 3. DESIGN DEPTH ESTABLISHED IN FINAL DESIGN OR IN FIELD. TOP OF DIKE TO FLOWLINE OF DITCH SHALL PROVIDE 1 FOOT OF FREEBOARD FROM DESIGN DEPTH.
- 4. INSPECTION TRENCH TO BE CONSTRUCTED ALONG ENTIRE LENGTH OF PERIMETER DIKES WHERE NON-ORGANIC
- 5. PERIMETER DITCH AND DIKE ALONG THE NORTH SIDE OF THE CATEGORY 1 STOCKPILE (STATION 10+00 TO 143+53) SHALL HAVE 2.5H:1V SIDE SLOPES. ALL OTHER DITCHES AND DIKES SHALL HAVE SIDE SLOPES OF 3H:1V.

MINE SITE STORMWATER TYPICAL DIKES AND DITCHES CROSS SECTIONS

BARR

SW-007

POLY MET MINING, INC. NORTHMET PROJECT

HOYT LAKES, MINNESOTA

MINNEAPOLIS, MN.

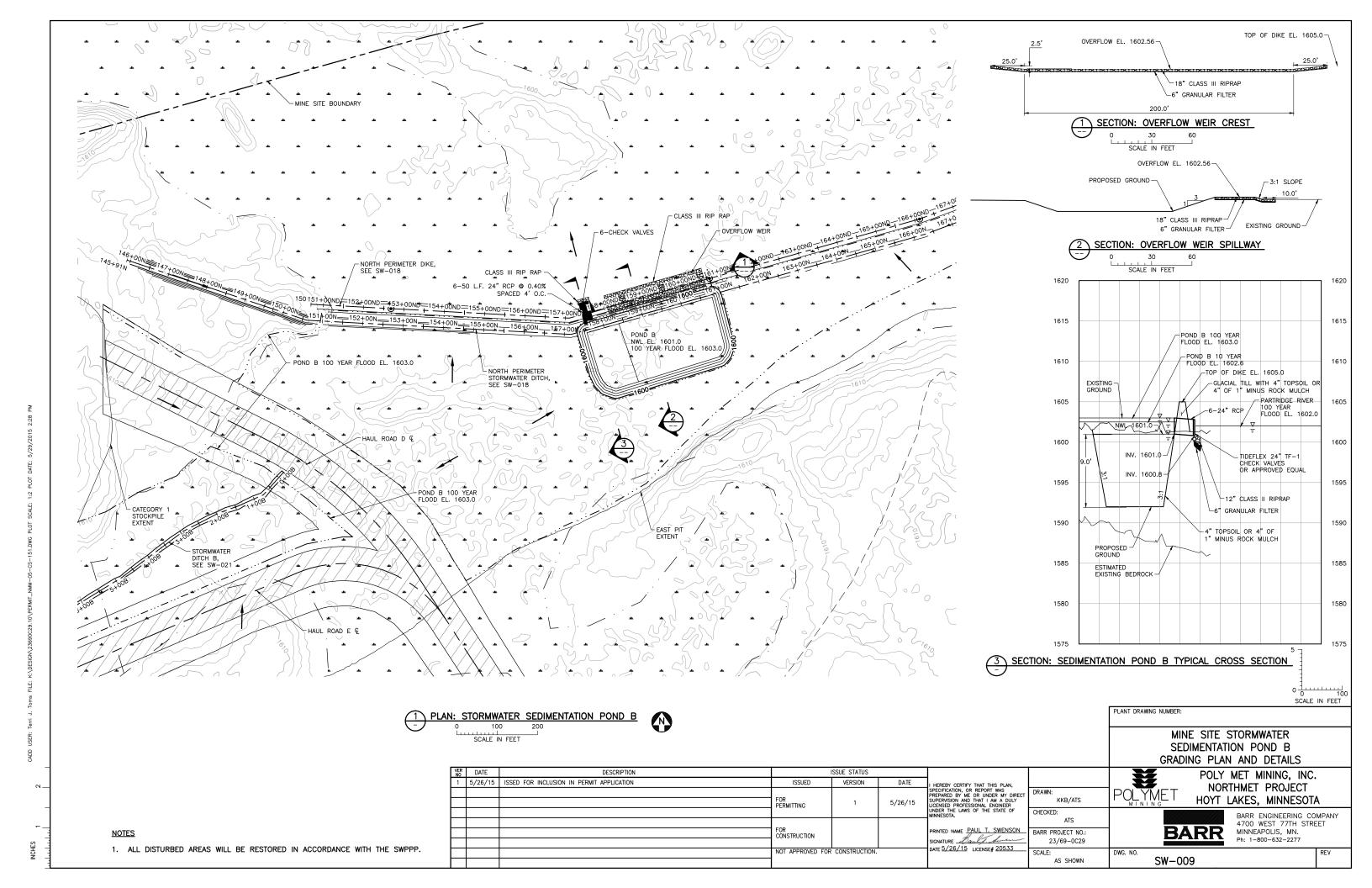
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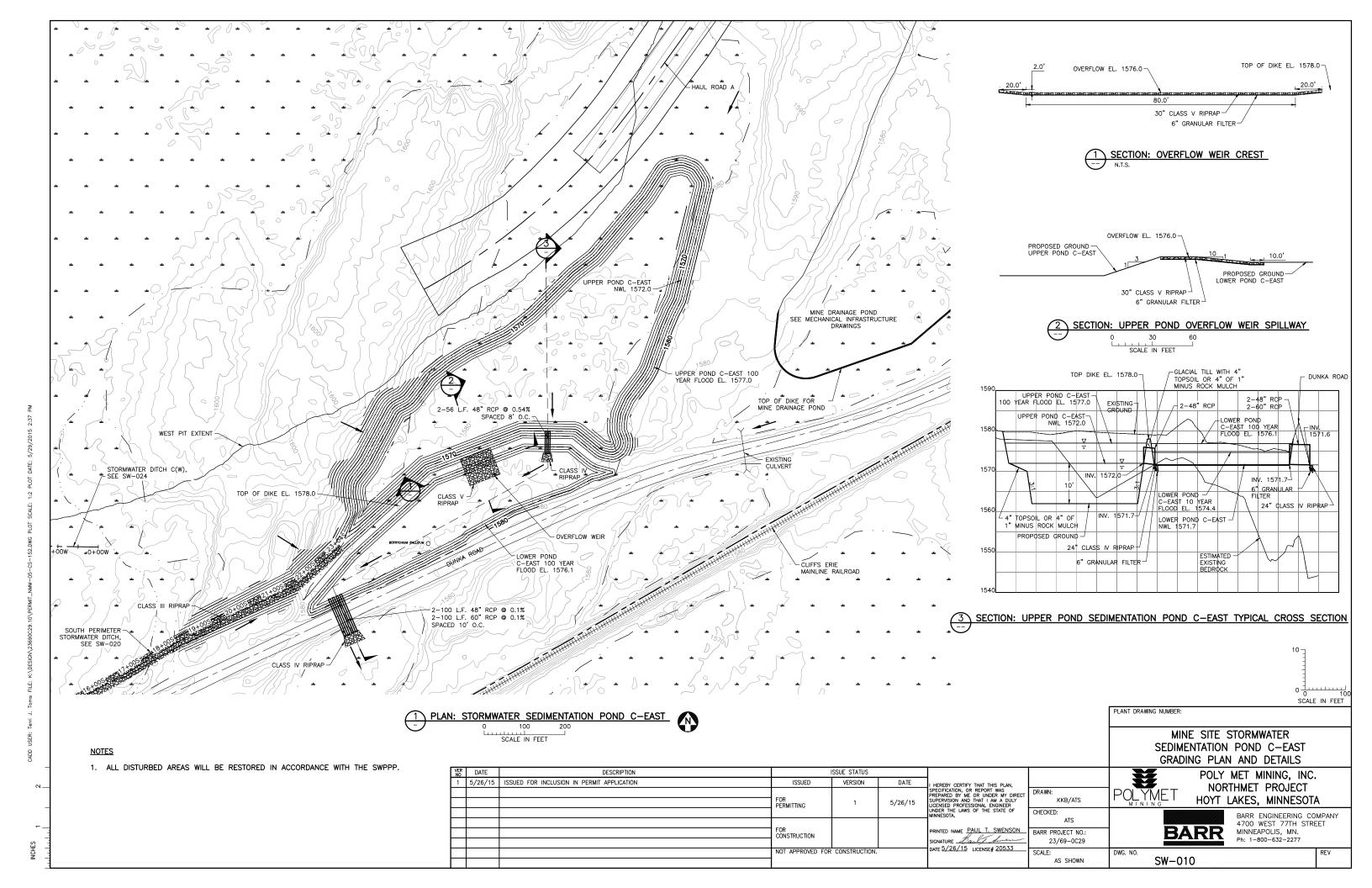
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET

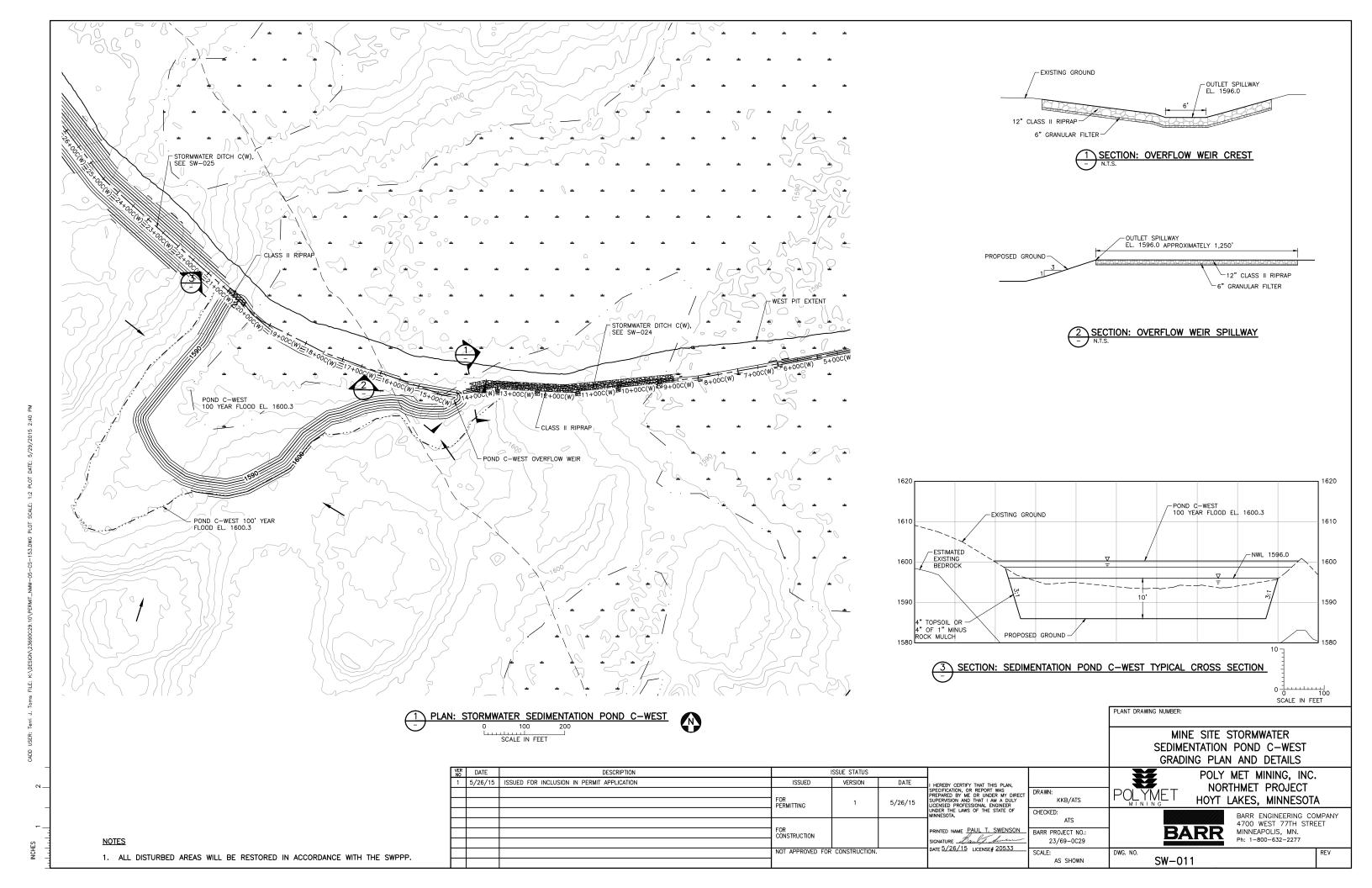
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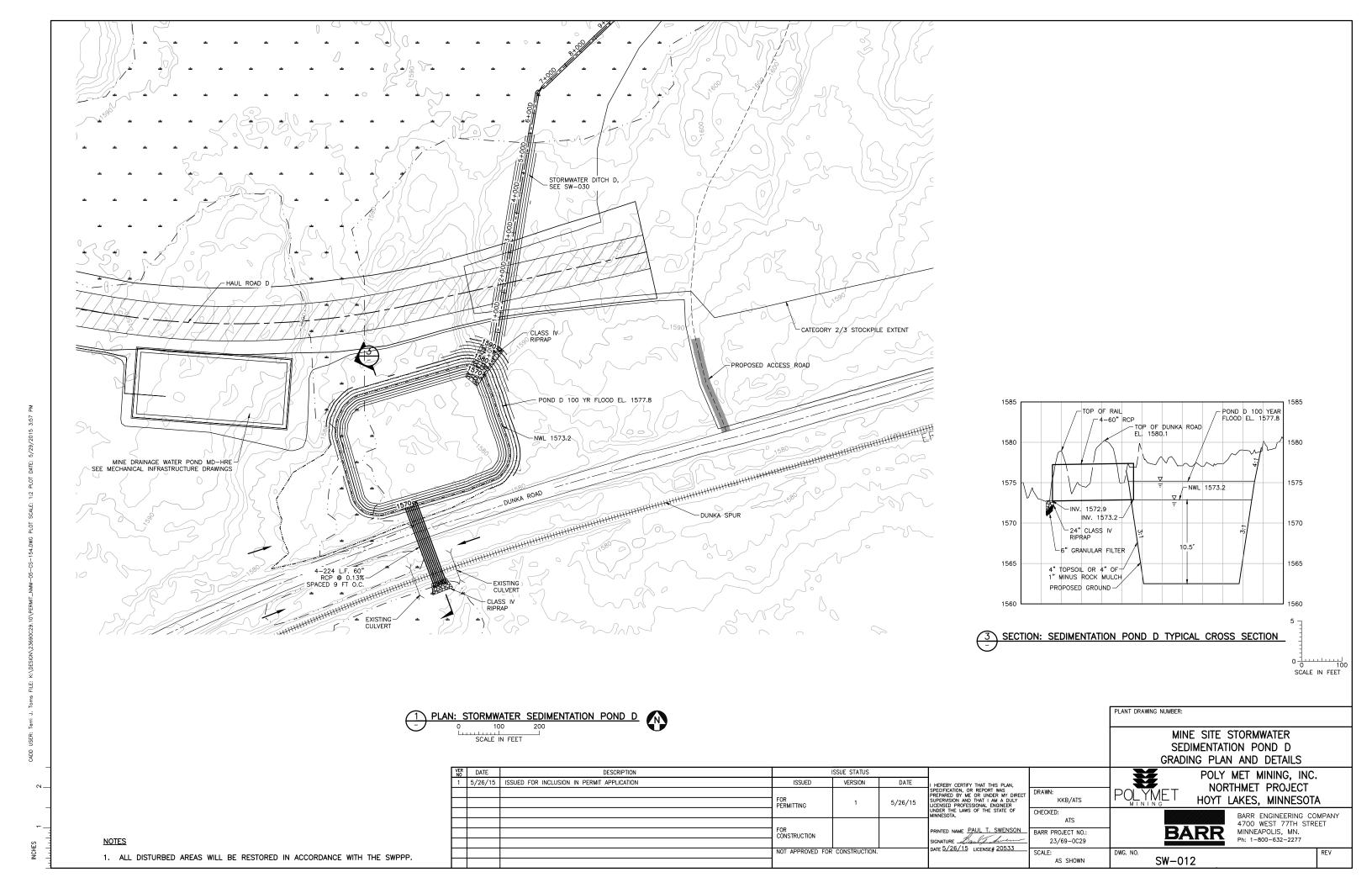
POLYMET

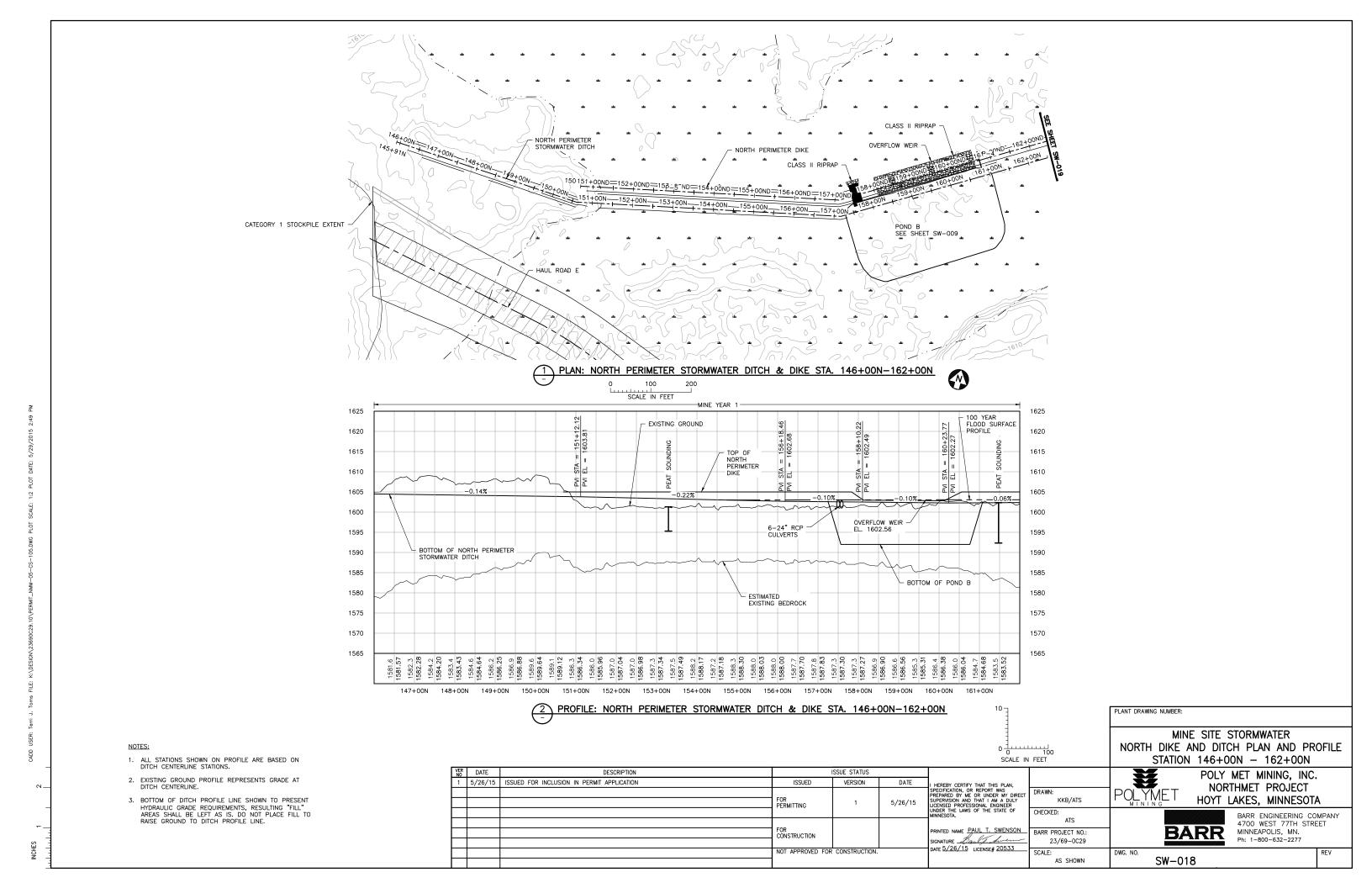
VER NO	DATE	DESCRIPTION	ISSUE STATUS						
1	5/26/15	ISSUED FOR INCLUSION IN PERMIT APPLICATION	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.			
			FOR PERMITTING	1	5/26/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: KKB/ATS		
			T ENMITTING				CHECKED:		
]				ATS		
			FOR CONSTRUCTION					PRINTED NAME PAUL T. SWENSON	BARR PROJECT NO.:
								SIGNATURE Baulf Summer DATE 5/26/15 LICENSE# 20533	23/69-0029
			NOT APPROVED FOR CONSTRUCTION.		DATE 3/20/13 LICENSE# 20333	SCALE:			
			1			1	AS SHOWN		

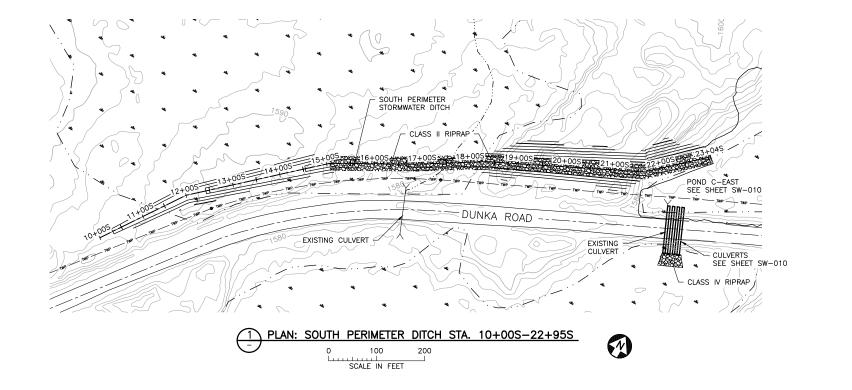


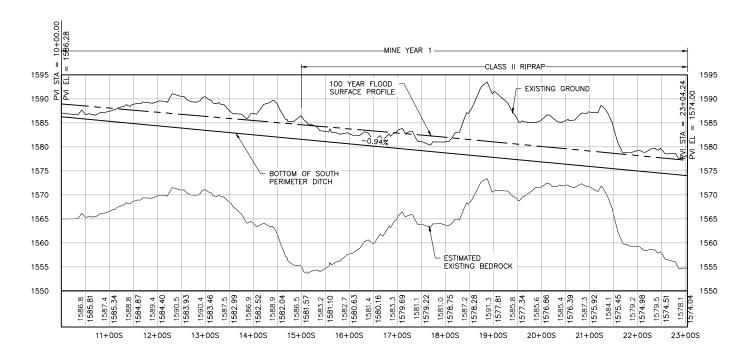












NOTES:

- ALL STATIONS SHOWN ON PROFILE ARE BASED ON DITCH CENTERLINE STATIONS.
- 2. EXISTING GROUND PROFILE REPRESENTS GRADE AT DITCH CENTERLINE.

PROFILE: SOUTH PERIMETER DITCH STA. 10+00S-22+95S

SCALE IN FEET

_											
Γ	VER D	DATE	DESCRIPTION	ISSUE STATUS							
Γ	1 5/	²⁶ /15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.				
F				FOR PERMITTING FOR CONSTRUCTION	FOR CONSTRUCTION			1	E /00 /1E	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: KKB/ATS
Γ								UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:		
									ATS		
						CONSTRUCTION		l	PRINTED NAME PAUL T. SWENSON	BARR PROJECT NO.:	
L											
				NOT APPROVED FOR	FOR CONSTRUCTION.		DATE 3/20/13 LICENSE# 20333	SCALE:			
Г								AS SHOWN			

MINE SITE STORMWATER SOUTH DIKE AND DITCH PLAN AND PROFILE STATION 10+00S - 22+95S

POLYME1

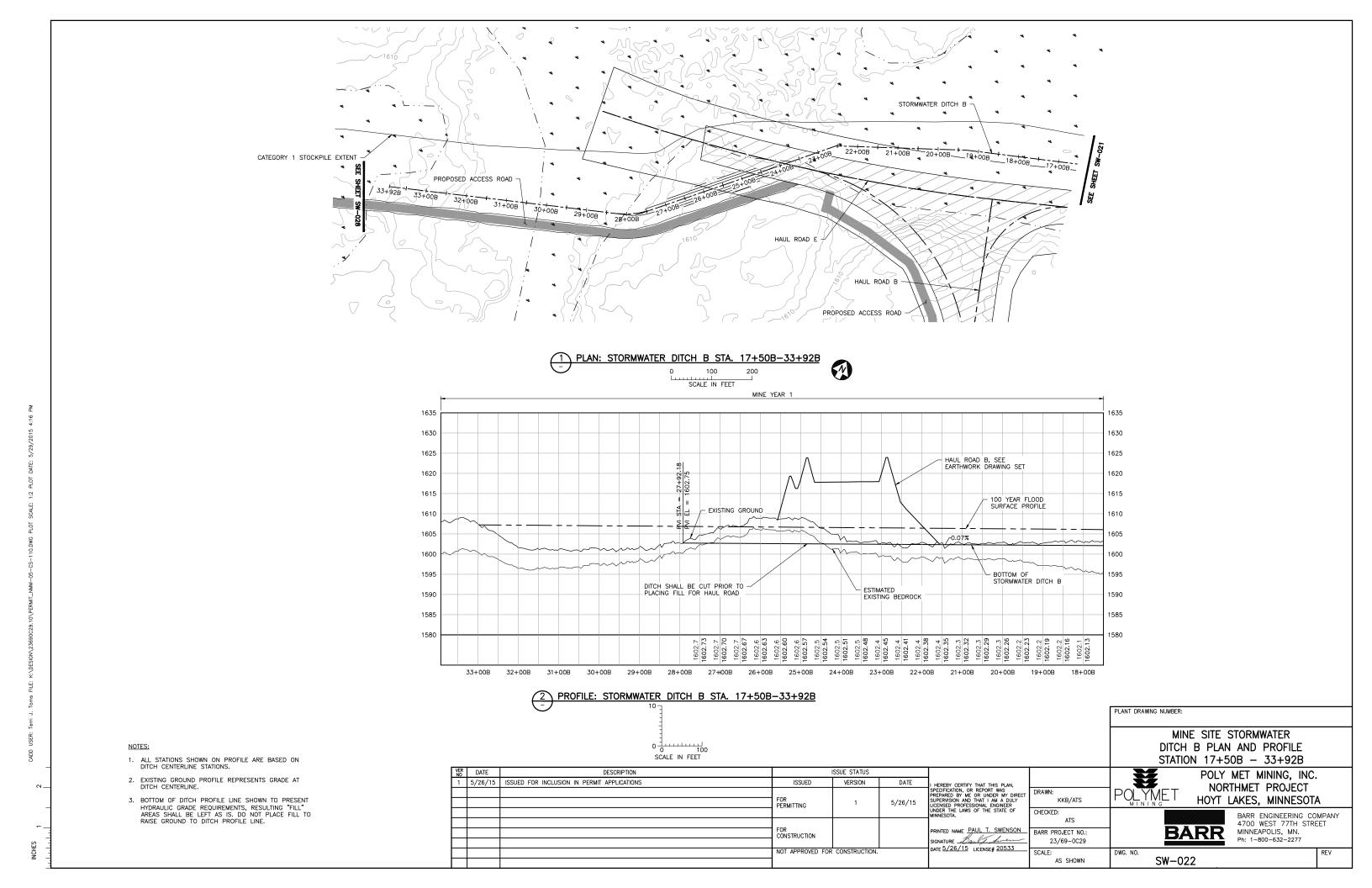
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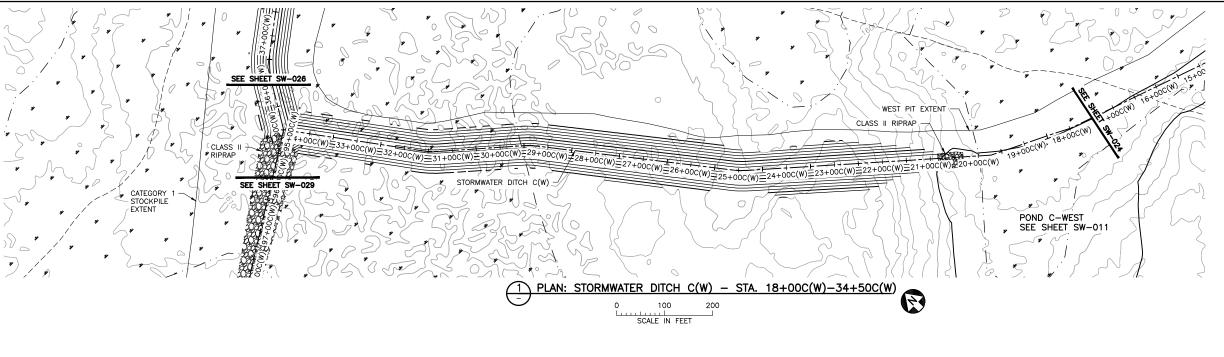
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

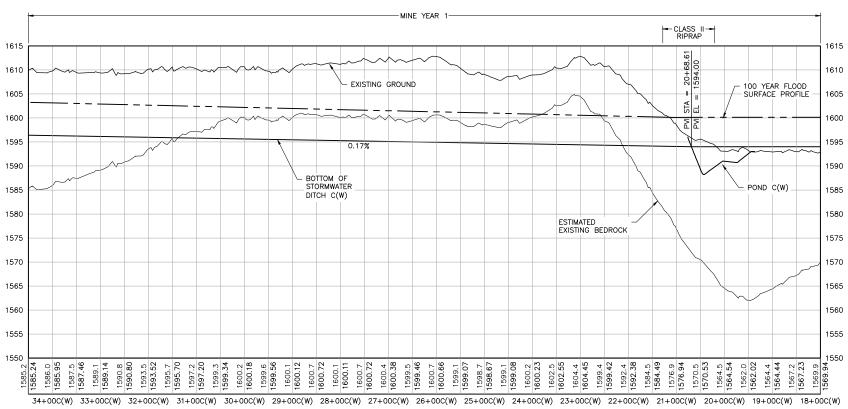
BARR

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

Ph: 1-800-632-2277 SW-020







PROFILE: STORMWATER DITCH C(W) - STA. 18+00C(W)-34+50C(W)

SCALE IN FEET

MINE SITE STORMWATER DITCH C(W) PLAN AND PROFILE STATION 18+00C(W) - 34+50C(W)

VER DATE DESCRIPTION ISSUE STATUS 5/26/15 ISSUED FOR INCLUSION IN PERMIT APPLICATION HEREBY CERTIFY THAT THIS PLAN, PECIFICATION, OR REPORT WAS REPARED BY ME OR UNDER MY DIRECT UPERVISION AND THAT I AM A DULY ICENSED PROFESSIONAL ENGINEER INDER THE LAWS OF THE STATE OF INNERSTATE. ISSUED VERSION DATE FOR PERMITTING 5/26/15 CHECKED: FOR CONSTRUCTION RINTED NAME PAUL T. SWENSON BARR PROJECT NO .: SIGNATURE Bault Swen DATE 5/26/15 LICENSE# 20533 NOT APPROVED FOR CONSTRUCTION.

POLY MET MINING, INC. NORTHMET PROJECT POLYME HOYT LAKES, MINNESOTA

PLANT DRAWING NUMBER:

KKB/ATS

23/69-0029

AS SHOWN

BARR

SW-025

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

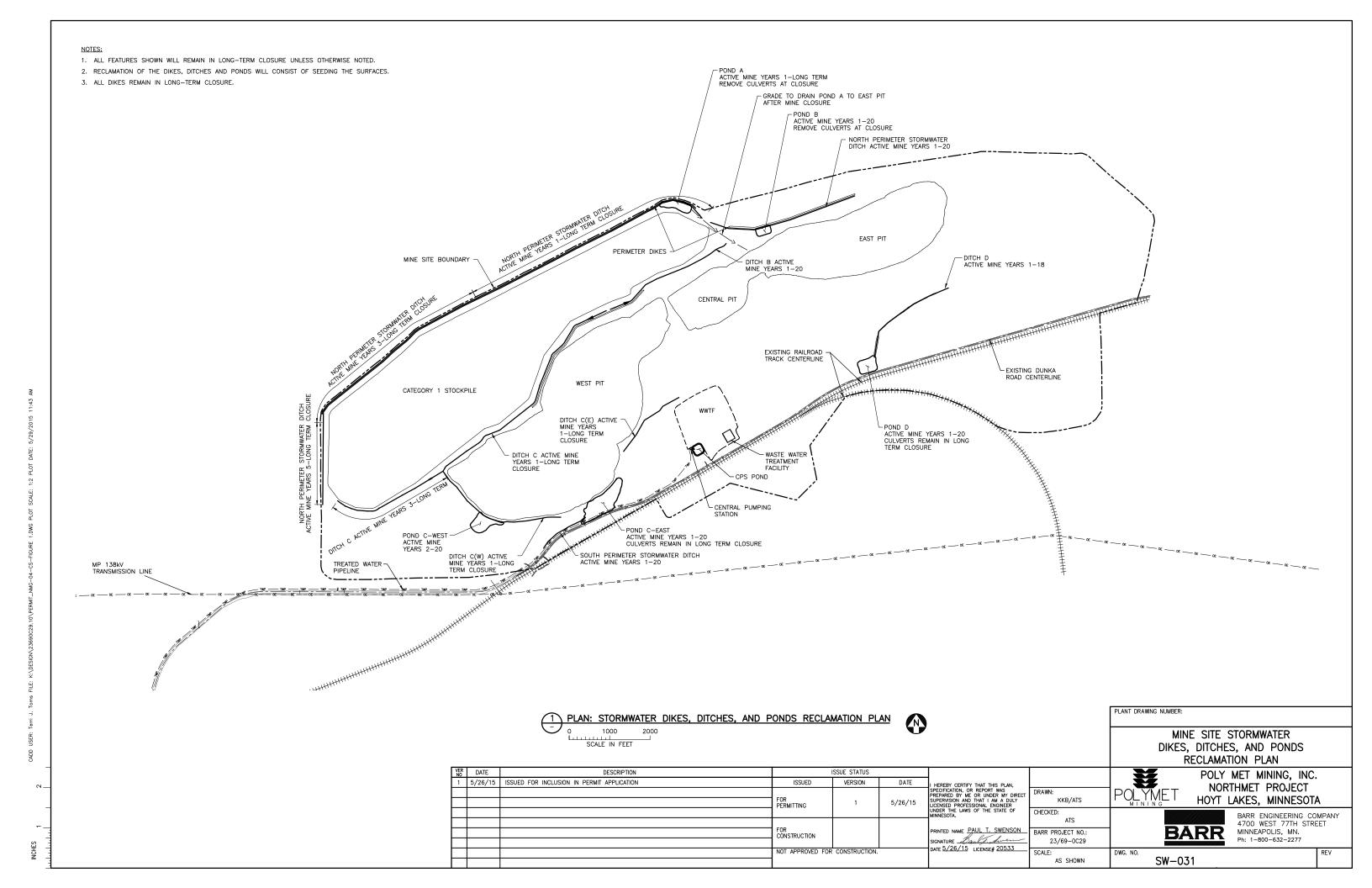
NOTES:

ALL STATIONS SHOWN ON PROFILE ARE BASED ON DITCH CENTERLINE STATIONS.

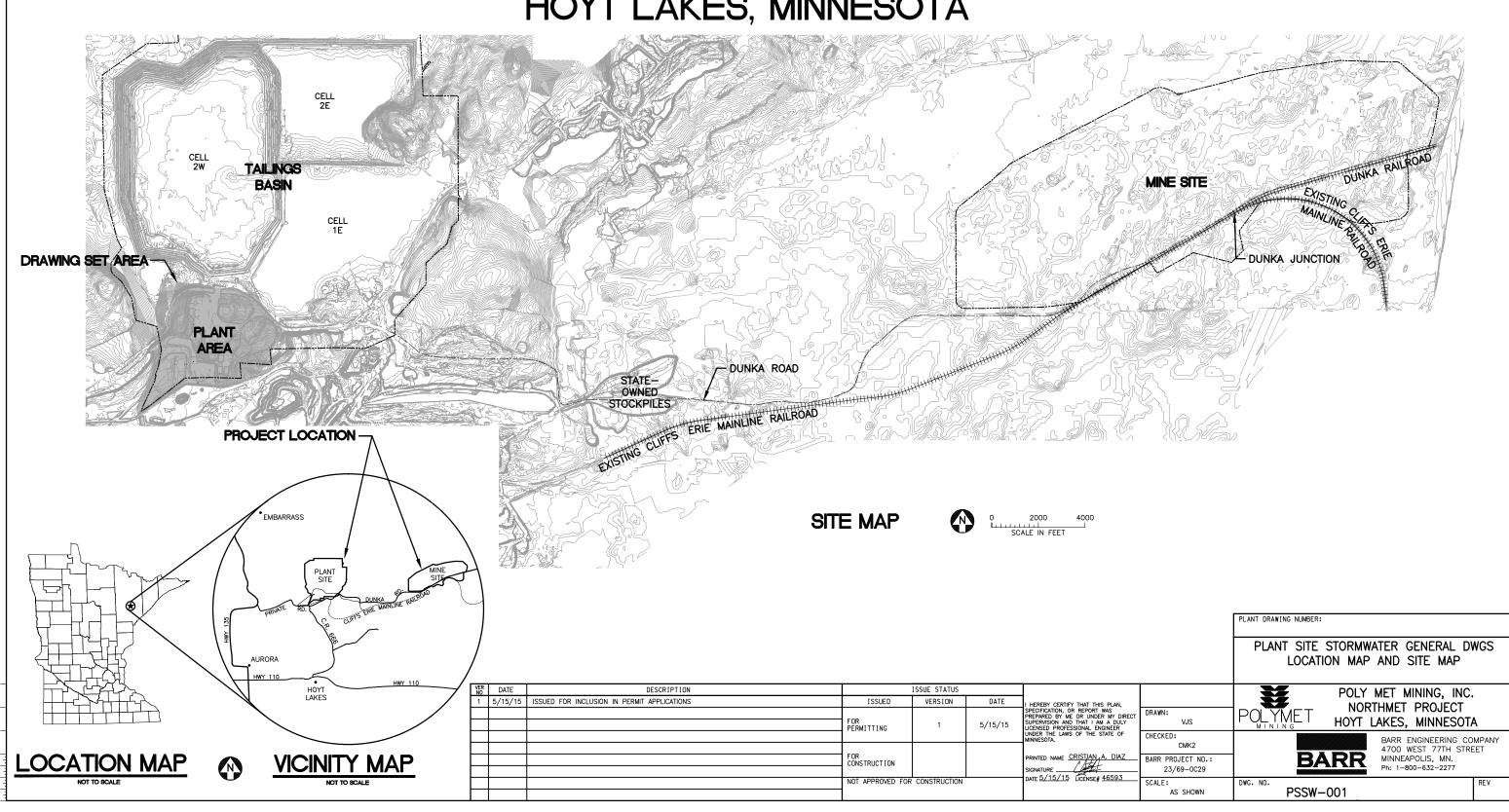
2. EXISTING GROUND PROFILE REPRESENTS GRADE AT DITCH CENTERLINE.

3. BOTTOM OF DITCH PROFILE LINE SHOWN TO PRESENT

HYDRAULIC GRADE REQUIREMENTS, RESULTING "FILL"
AREAS SHALL BE LEFT AS IS. DO NOT PLACE FILL TO
RAISE GROUND TO DITCH PROFILE LINE.



Plant Site Stormwater



PLANT SITE STORMWATER LEGEND

EXISTING PROPOSED ---1000----PROPOSED CONTOUR - MAJOR 5' EXISTING CONTOUR - MINOR 2' PROPOSED CONTOUR - MINOR 1' ++++++ EXISTING RAILROAD PROPOSED CENTERLINE STATIONING 1+00X ----- WATER EDGE/CREEK CENTER LINE PROPOSED CULVERT (STORMWATER) EXISTING ROAD PROPOSED PIPE EXISTING STRUCTURES 0 PROPOSED MANHOLE/CATCH BASIN TREE LINE PROPOSED RIPRAP EXISTING MANHOLE/CATCH BASIN PROJECT AREA BOUNDARY > EXISTING CULVERT FLOW PATH ----X--- EXISTING FENCE PROPOSED OTHER FACILITY WETLAND BOUNDARY PROPOSED STRUCTURES PROPOSED RAILROAD

NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH

SHEET INDEX

SHEET NO. TITLE

PLANT SITE STORMWATER DRAWINGS

PSSW-001 PSSW-002 PSSW-003 PSSW-004 TO PSSW-015 LOCATION MAP & SITE MAP LEGEND & SHEET INDEX GENERAL LAYOUT & SHEET INDEX MAP GRADING PLANS GRADING PROFILES

ABBREVIATIONS

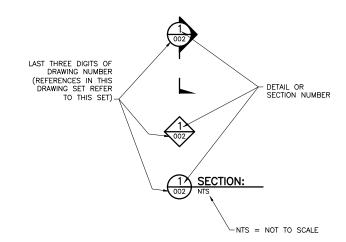
AC-FT AVE CB Q CMP DS DV DWG ACRE-FEET AVERAGE
CATCH BASIN
CENTERLINE
CORRUGATED METAL PIPE DOWNSTREAM DOWNSTREAM
DRAIN VALVE
DRAWING
ELEVATION
FLOTATION TAILINGS BASIN

GALLONS
GALLONS PER MINUTE
HIGH—DENSITY POLYETHYLENE

INVERT LINEAR FEET MANHOLE

EL. FTB GAL GPM HDPE INV LF MH MIN NWL PSSW SDR STA TYP US MINIMUM NORMAL WATER LEVEL PLANT SITE STORMWATER STANDARD DIMENSION RATIO

DRAWING NUMBERING



PLANT SITE STORMWATER GENERAL DWGS LEGEND AND SHEET INDEX

PLANT DRAWING NUMBER:

POLYME

VER NO	DATE	DESCRIPTION		ISSUE STATUS			
1	5/15/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,	
			FOR PERMITTING	1	5/15/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LUCENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME CRISTIAN A. DIAZ SIGNATURE B.	DRAWN: VJS
							CHECKED: CMK2
			FOR CONSTRUCTION				BARR PROJECT NO.: 23/69-0C29
			NOT APPROVED FOR CONSTRUCTION			DATE <u>5/15/15</u> LICENSE# <u>46593</u>	SCALE: AS SHOWN

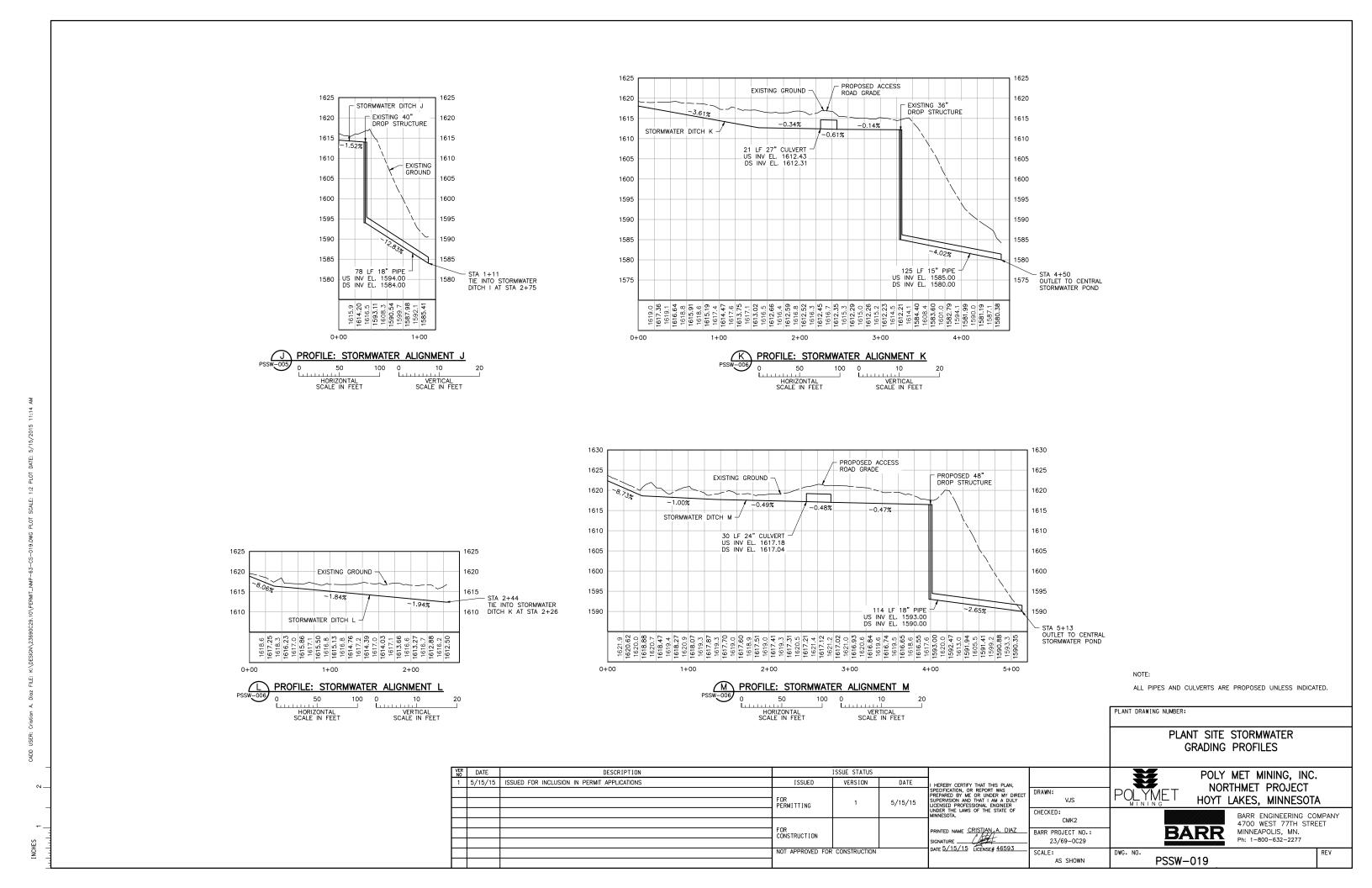
BARR Ph: 1-800-632-2277 PSSW-002

POLY MET MINING, INC. NORTHMET PROJECT

HOYT LAKES, MINNESOTA

MINNEAPOLIS, MN.

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET



PROPOSED CB #2 -

1585 1580

1575

1570

(REPLACE EXISTING) RIM EL. 1578.40 INV EL. 1569.24

1590

1585

1580

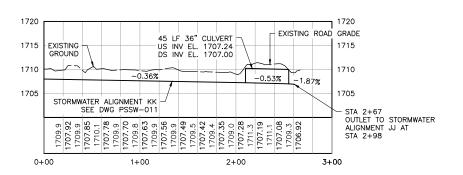
1575

1570

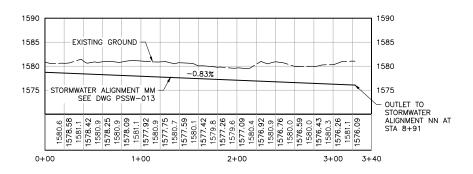
EXISTING GROUND -

-0.62%

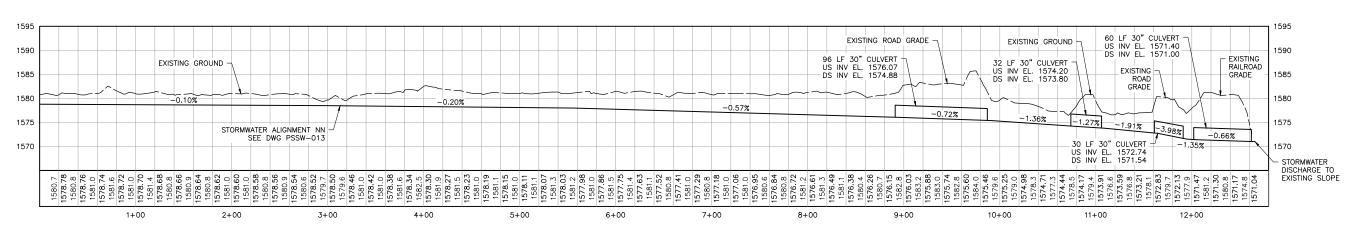
STORMWATER ALIGNMENT Q











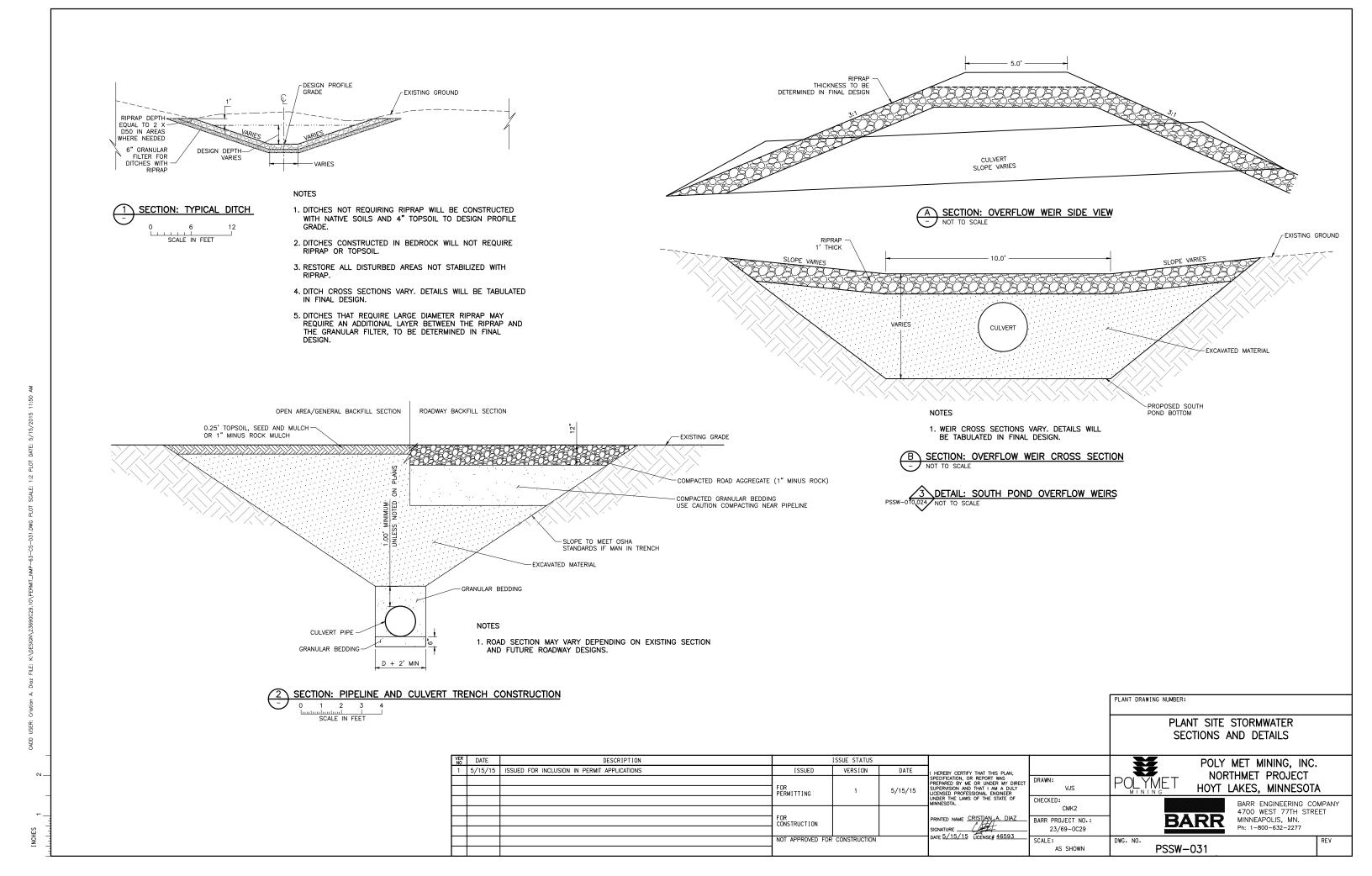
NN PROFILE: STORMWATER ALIGNMENT NN 50 HORIZONTAL SCALE IN FEET VERTICAL SCALE IN FEET

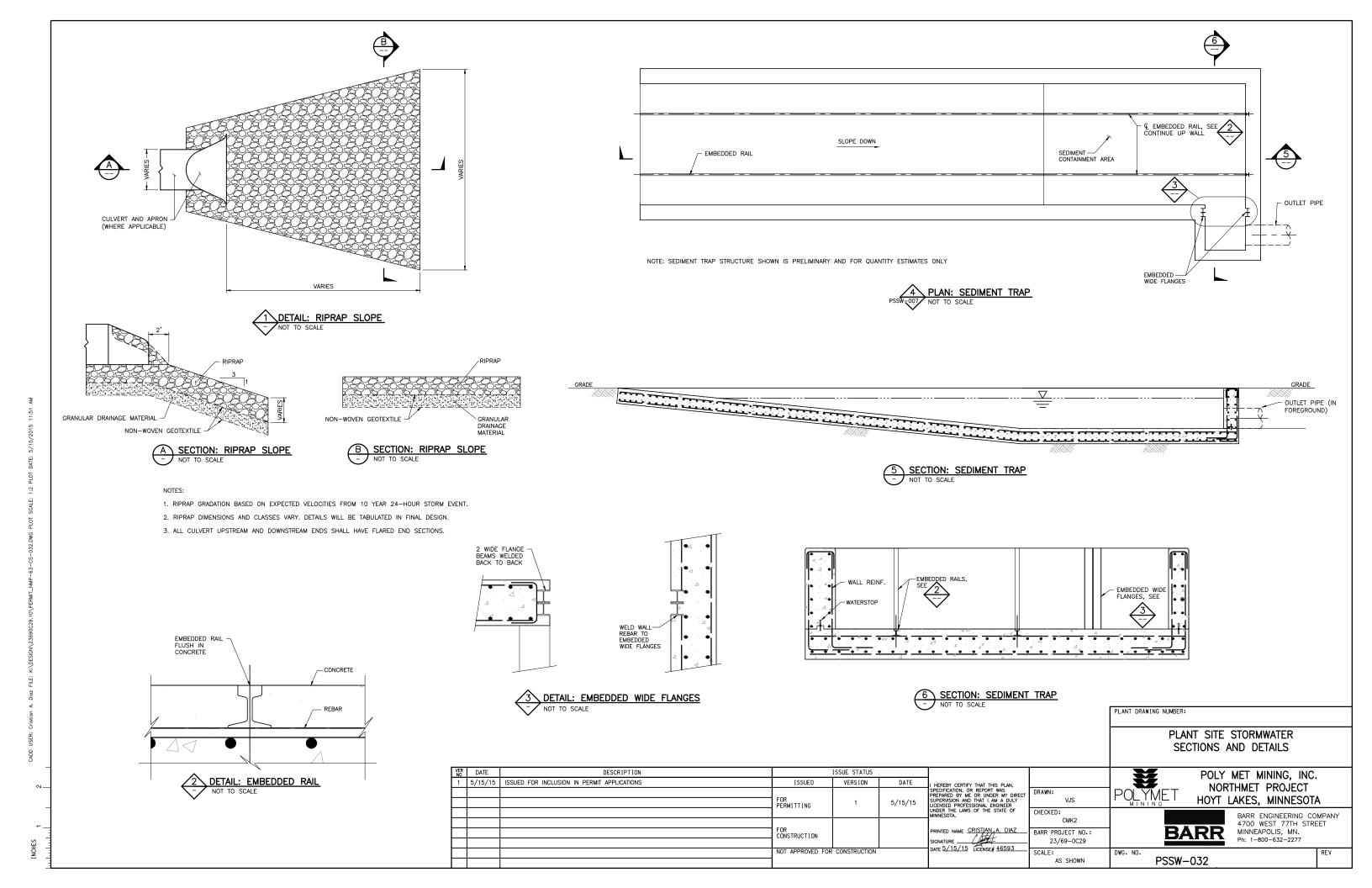
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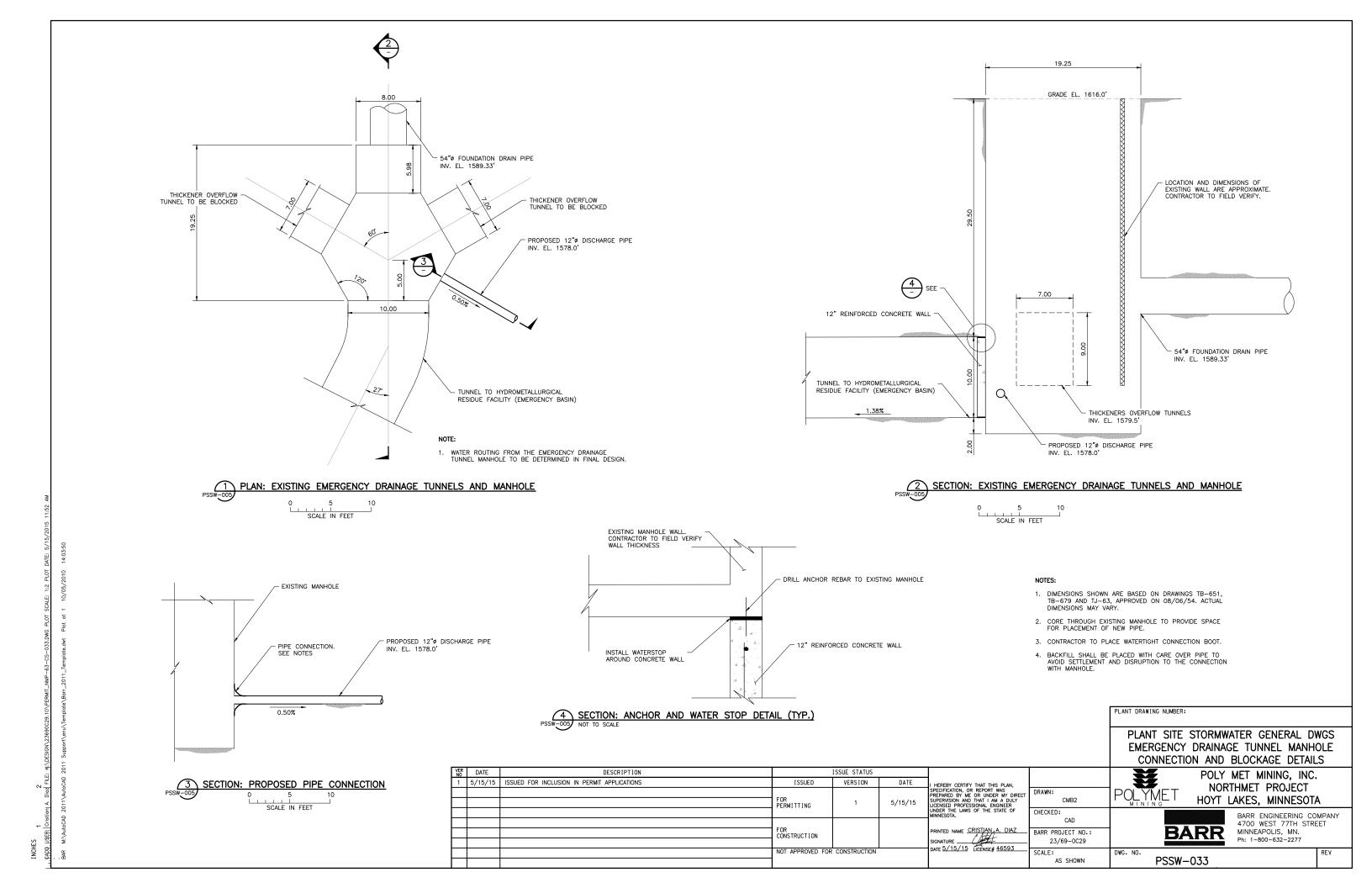
PLANT DRAWING NUMBER:

ALL PIPES AND CULVERTS ARE PROPOSED UNLESS INDICATED.

									PLANT SITE STORMWATER GRADING PROFILES		
	VER DA	ATE	DESCRIPTION	ISSUE STATUS					***	POLY MET MINING, INC	
	1 5/1	5/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,			NORTHMET PROJECT	•
E				FOR PERMITTING FOR CONSTRUCTION	1	5/15/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME CRISTIAN A. DIAZ SIGNATURE. DATE 5/15/15 LICENSE 45593	DRAWN: PRT	POLYMET	HOYT LAKES, MINNESOTA	
								CHECKED:		BARR ENGINEERING CO	YNAPMC
L								CMK2	4700 WEST 77TH		EET
L								BARR PROJECT NO.:	l BA	MINNEAPOLIS, MN. Ph: 1-800-632-2277	
L								23/69-0C29		Pri: 1-800-632-2277	
╁				NOT APPROVED FOR CONSTRUCTION			DATE ST. 107 10 CICENSE# 10000	SCALE: AS SHOWN	DWG. NO. PSSW-	029	REV

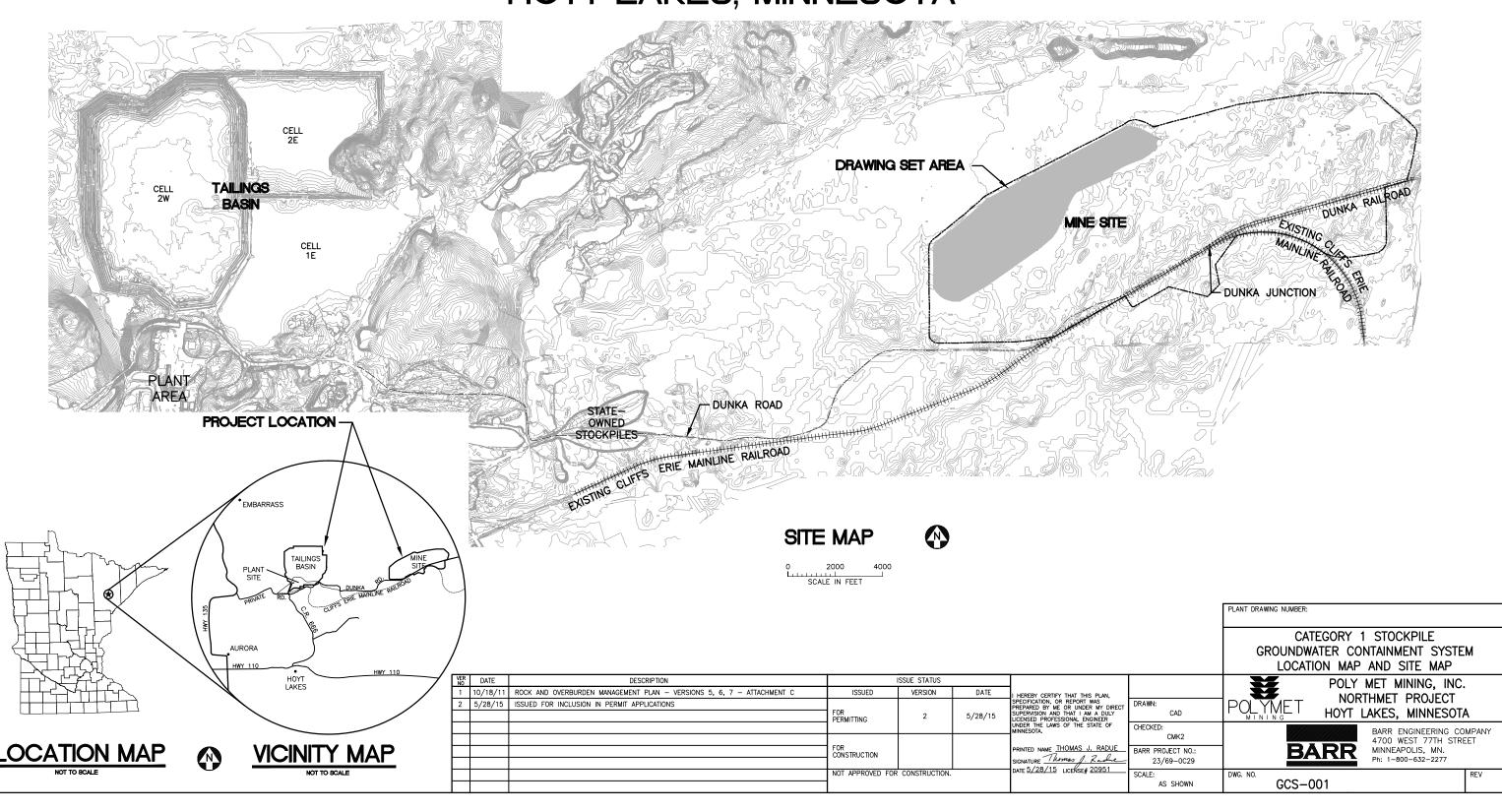






Category 1 Stockpile Groundwater Containment System

POLY MET MINING, INC. NORTHMET PROJECT PERMIT APPLICATION SUPPORT DRAWINGS CATEGORY 1 STOCKPILE GROUNDWATER CONTAINMENT SYSTEM HOYT LAKES, MINNESOTA



GENERAL LEGEND

-----1000----- EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR ---- MINE SITE BOUNDARY ----- OF ------ PROPOSED SUMP OVERFLOW PIPE PROPOSED MINE DRAINAGE PIPE (PUMPED FLOW) PROPOSED MINE DRAINAGE PIPE (GRAVITY FLOW) PROPOSED SUMP MANHOLE PROPOSED ACCESS ROADS HAUL ROAD

ABBREVIATIONS

CAT CATEGORY DWG DRAWING EL ELEVATION

 GROUNDWATER CONTAINMENT SYSTEM GCS

МН MANHOLE

NTS NOT TO SCALE

PVI PROFILE VERTICAL INTERSECTION

STA STATION

WWTF - WASTE WATER TREATMENT FACILITY

DESCRIPTION

1 10/18/11 ROCK AND OVERBURDEN MANAGEMENT PLAN - VERSIONS 5, 6, 7 - ATTACHMENT C

2 5/28/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

SHEET INDEX

SHEET NO. TITLE

GENERAL DRAWINGS

GENERAL DRAWINGS

GCS-001 LOCATION MAP AND SITE MAP
GCS-002 LEGEND AND SHEET INDEX
GCS-003 MINE YEAR 0 LAYOUT
GCS-004 MINE YEAR 2 LAYOUT
GCS-005 MINE YEAR 3 LAYOUT
GCS-006 MINE YEAR 3 LAYOUT
GCS-007 MINE YEAR 6 LAYOUT
GCS-008 MINE YEAR 6 LAYOUT
GCS-009 CLOSURE CONFIGURATION
GCS-010 TYPICAL CROSS SECTIONS
GCS-011 TYPICAL CROSS SECTIONS
GCS-012 NORTH PROFILES
GCS-013 SOUTH PROFILES
GCS-014 DISCHARGE PROFILES

DRAWING NUMBERING

ISSUE STATUS

VERSION

DATE

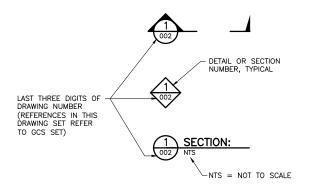
5/28/15

ISSUED

FOR PERMITTING

FOR CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.



I HEREBY CERTIFY THAT THIS PLAN,
SPECIFICATION, OR REPORT WAS
PREPARED BY ME OR UNDER MY DIRECT
SUPERVISION AND THAT I AM A DULY
ICENSED PROFESSIONAL ENGINEER
INDER THE LAWS OF THE STATE OF
INNESOTA.

PRINTED NAME <u>THOMAS J. RADUE</u> SIGNATURE Thomas J. Radue

DATE 5/28/15 LICENSE# 20951

DRAWN:

CHECKED:

CAD

BARR PROJECT NO.:

23/69-0029

AS SHOWN

CATEGORY 1 STOCKPILE GROUNDWATER CONTAINMENT SYSTEM LEGEND AND SHEET INDEX

POLYMET

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

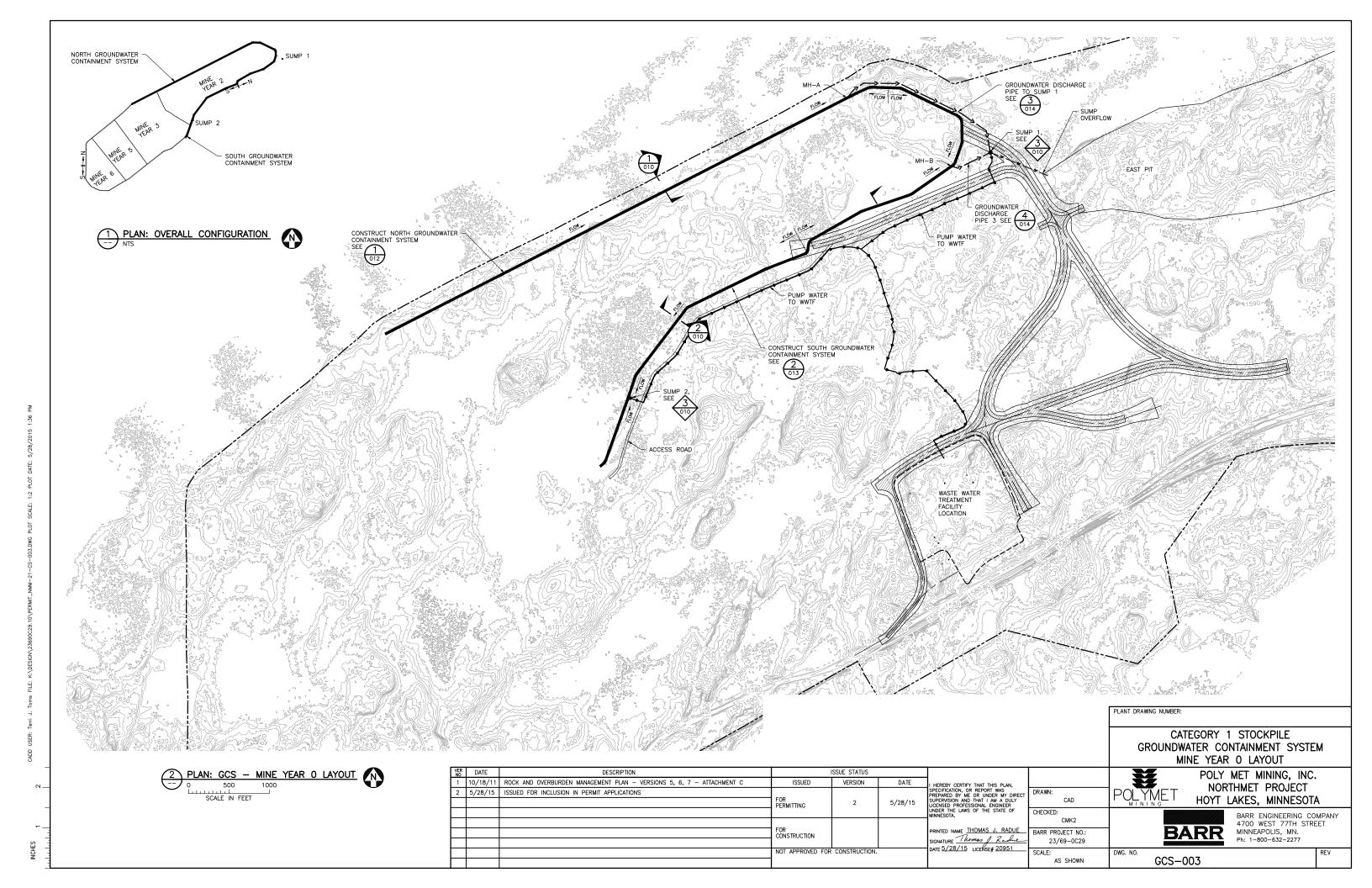
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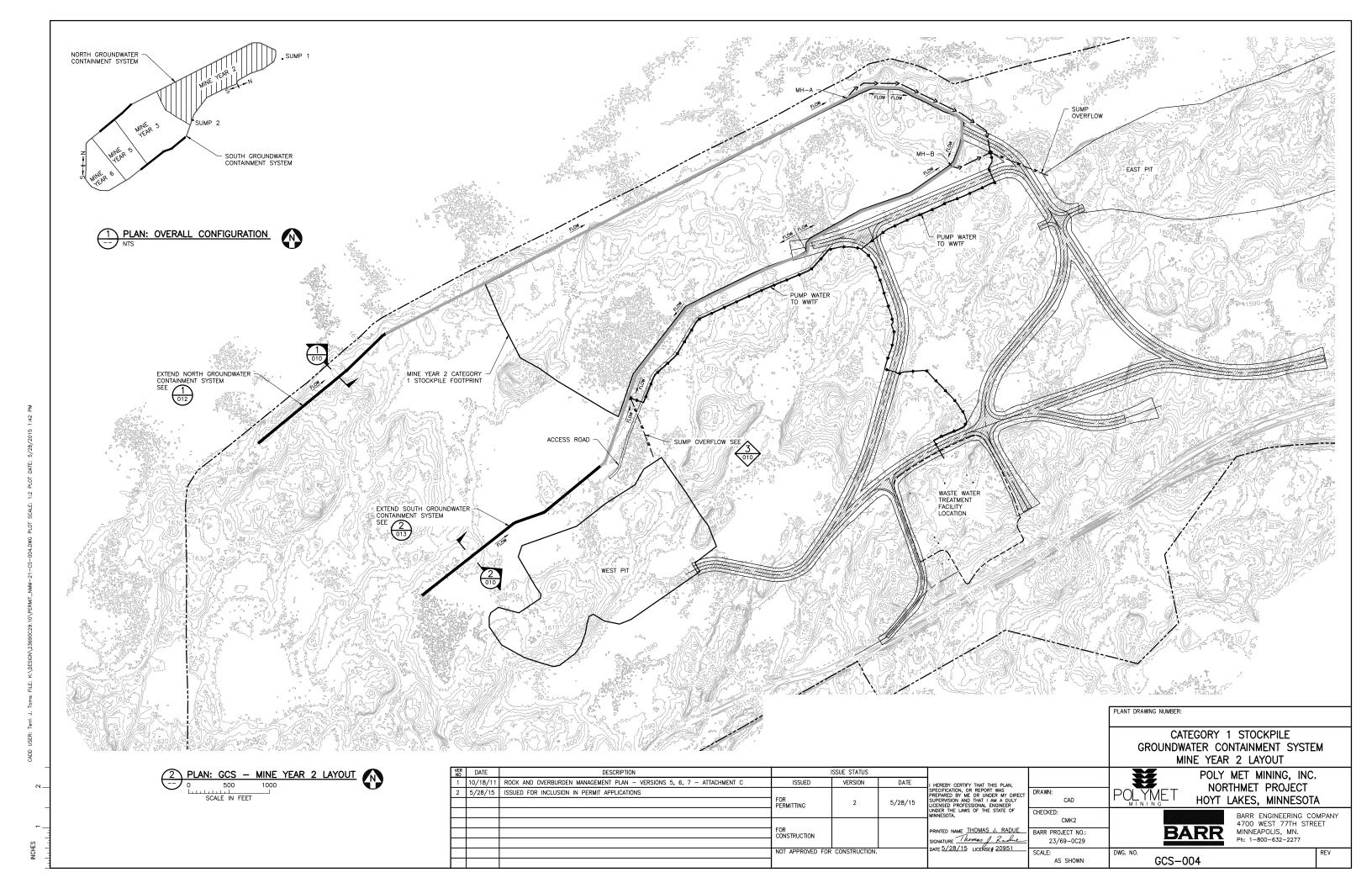
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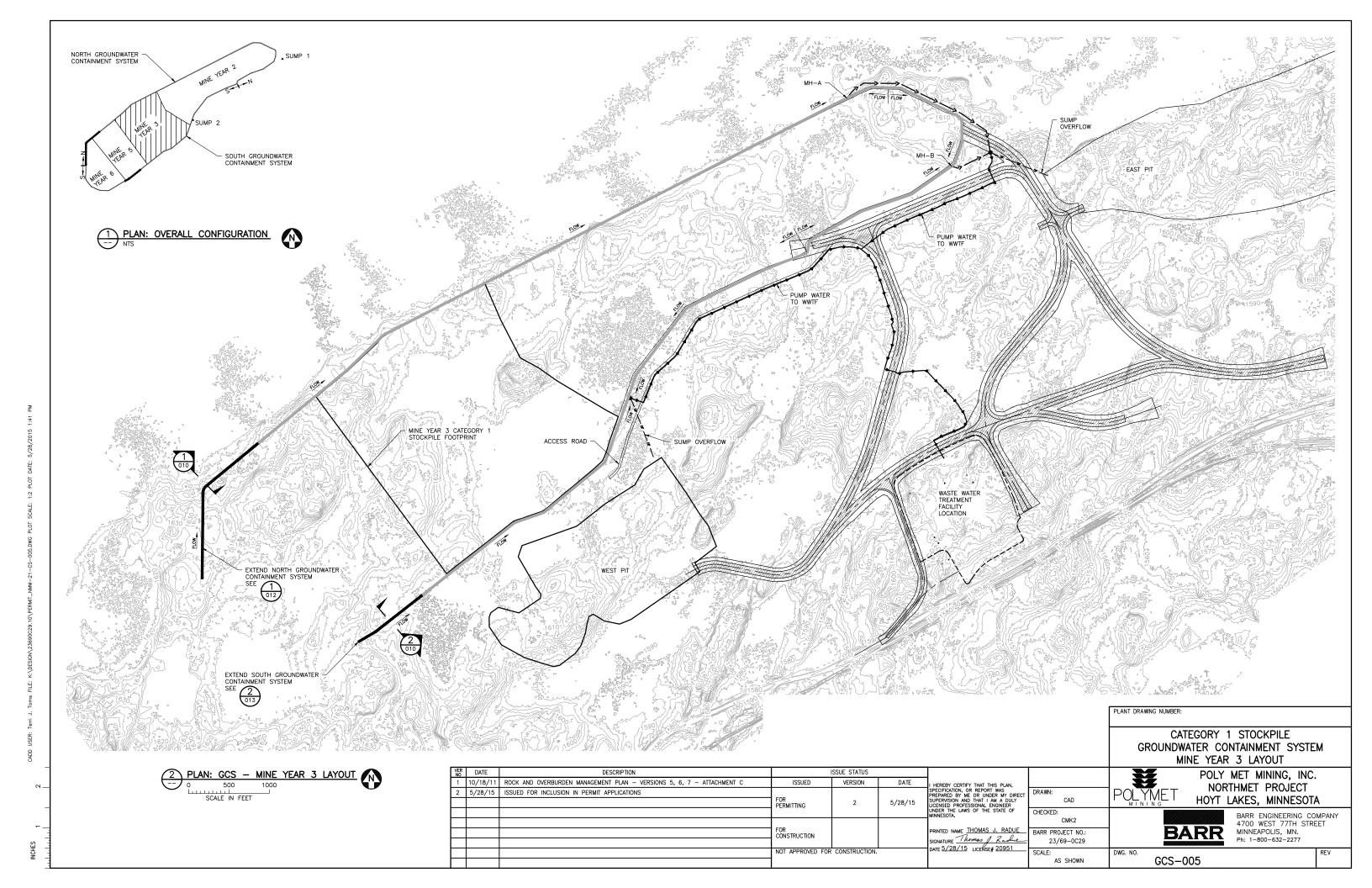
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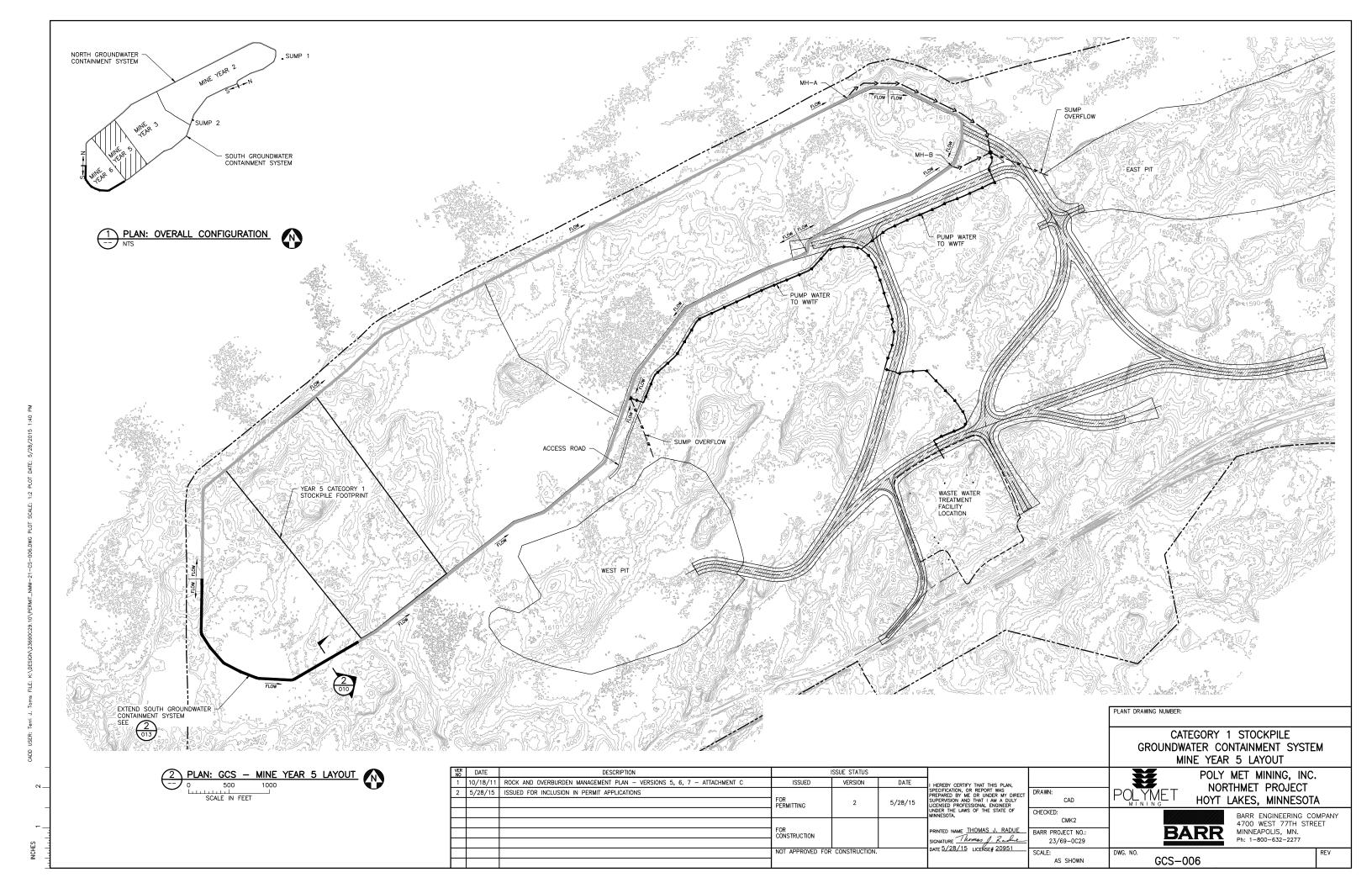
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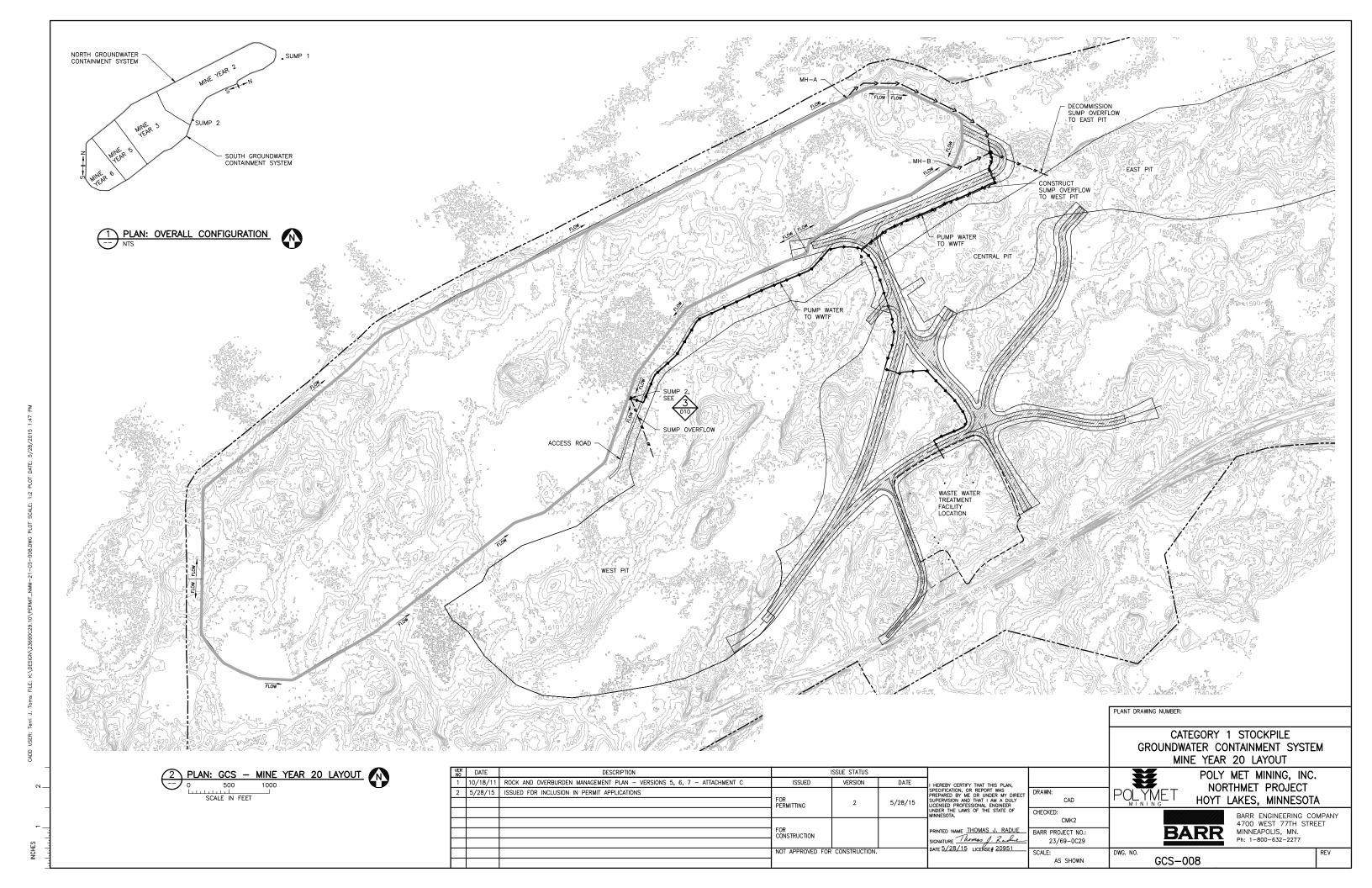
- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.

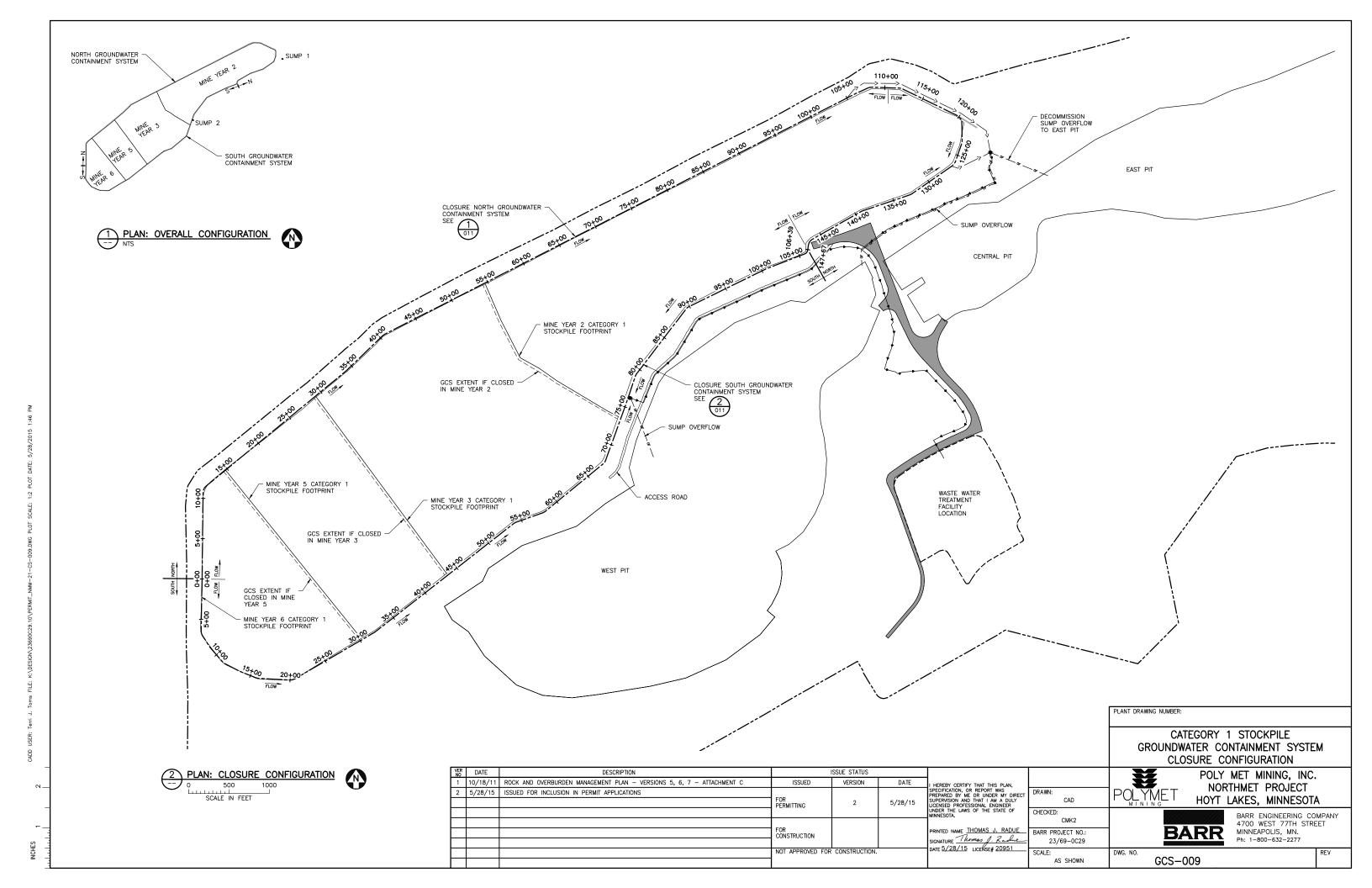


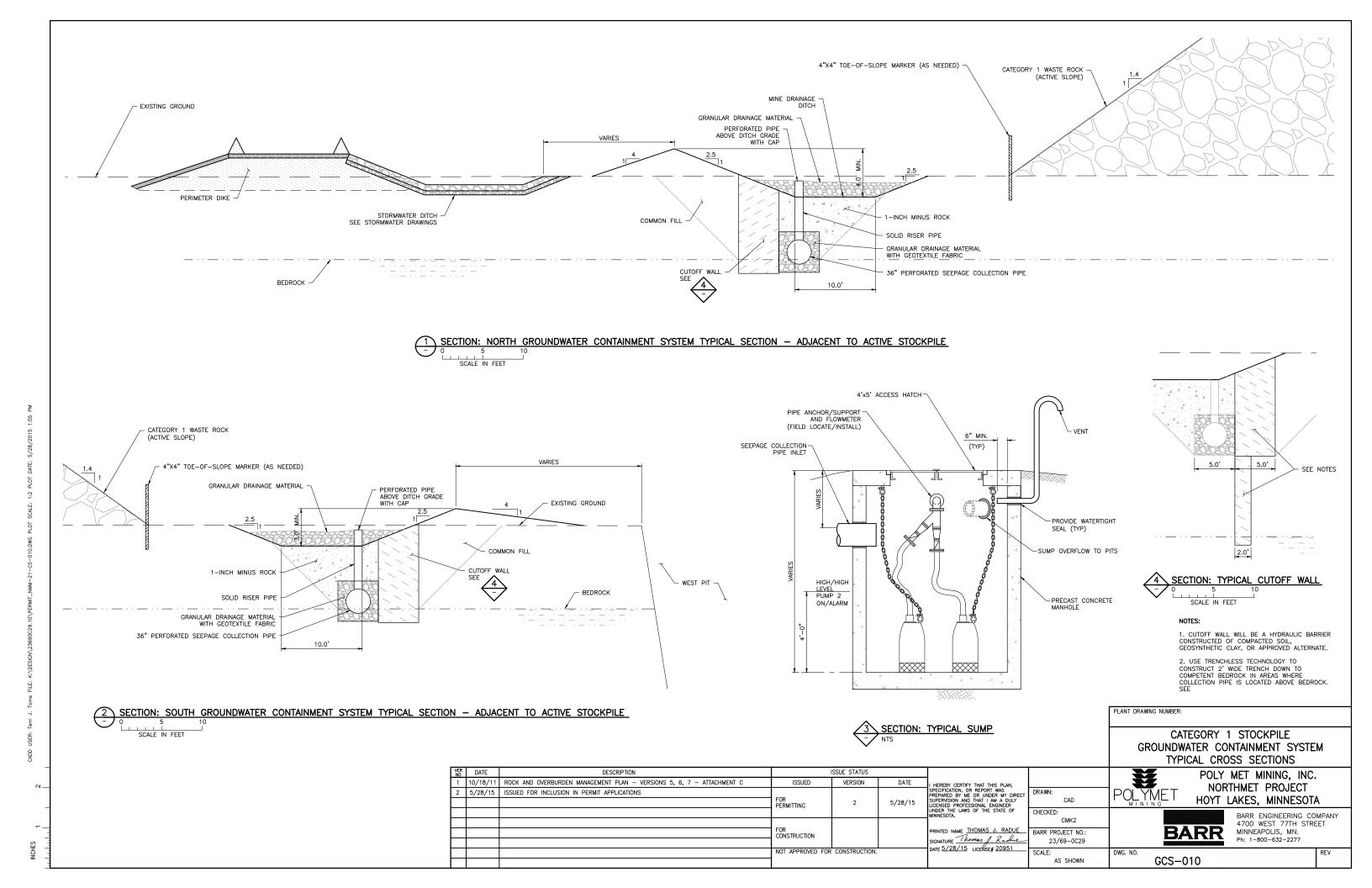












- EXISTING GROUND

CATEGORY 1 WASTE ROCK REGRADED TO FINAL GRADE

STOCKPILE COVER SEE STOCKPILE DRAWINGS

EXTEND SOLID PIPE TO FINISHED GROUND -MOVE CAP TO TOP OF PIPE

DRAIN ROCK TOE DRAIN -OVER GEOTEXTILE

VARIES

GEOMEMBRANE SEE STOCKPILE DRAWINGS

─ WEST PIT

CATEGORY 1 STOCKPILE

POLY MET MINING, INC.

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

Ph: 1-800-632-2277

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

AS SHOWN

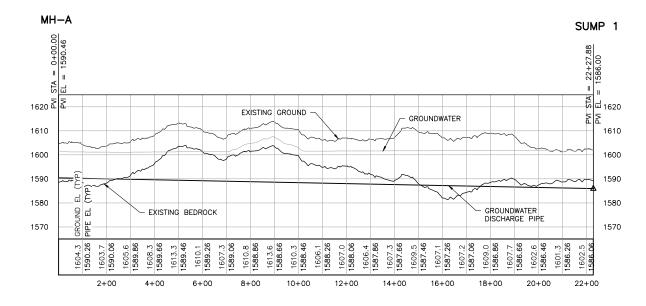
GCS-013

GROUNDWATER

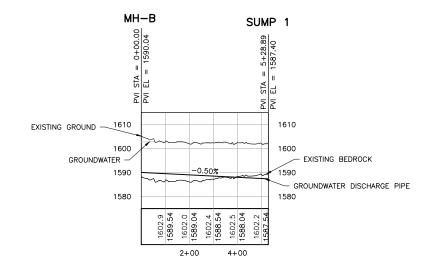
STA = 0+00.00 EL = 1612.02

1630

- EXISTING GROUND



PROFILE: MANHOLE A GROUNDWATER DISCHARGE PIPE TO SUMP 1



AS SHOWN

ALL GROUNDWATER AND BEDROCK PROFILES SHOWN ARE APPROXIMATE.

PROFILE: MANHOLE B GROUNDWATER DISCHARGE PIPE TO SUMP 1

CATEGORY 1 STOCKPILE
GROUNDWATER CONTAINMENT SYSTEM
DISCHARGE PROFILES

DISCHARGE PROFILES POLYMET POLY MET MINING, INC.

VER NO	DATE	DESCRIPTION	ISSUE STATUS												
1	10/18/11	ROCK AND OVERBURDEN MANAGEMENT PLAN - VERSIONS 5, 6, 7 - ATTACHMENT C	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.									
2	5/28/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS]		l	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:								
			FOR PERMITTING									2	3/26/13	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	CAD
						UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:								
							CMK2								
			FOR CONSTRUCTION				PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:							
						SIGNATURE Thomas J. Radue DATE 5/28/15 LICENSE# 20951	23/69-0C29								
			NOT APPROVED FOR CONSTRUCTION.			DATE 3/28/13 LICENSE# 20931	SCALE:								
			1				AS SHOWN								

HOYT LAKES, MINNESOTA **BARR**

PLANT DRAWING NUMBER:

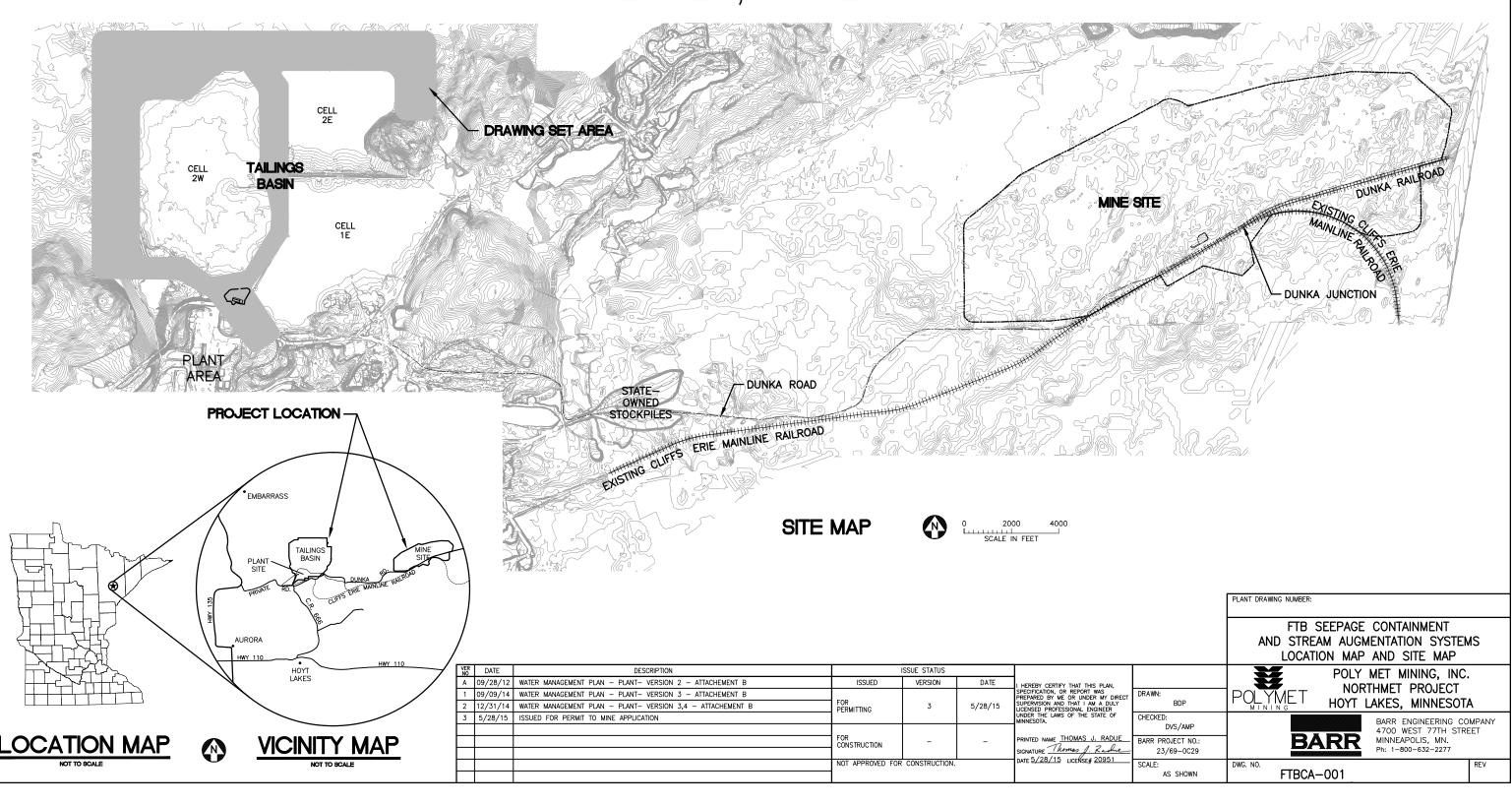
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

GCS-014

NORTHMET PROJECT

FTB Seepage Containment and Stream Augmentation Systems

POLY MET MINING, INC. NORTHMET PROJECT FTB SEEPAGE CONTAINMENT AND STREAM AUGMENTATION SYSTEMS HOYT LAKES, MINNESOTA



GENERAL LEGEND

EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR -----1000 ----- PROPOSED CONTOUR - MAJOR PROPOSED CONTOUR - MINOR FXISTING POWER POLE EXISTING RAILROAD EXISTING ROAD __ _ _ EXISTING TRAIL ______ EXISTING UNIMPROVED TRAIL EXISTING STRUCTURES TREE LINE <u>₩</u> } WETLAND BOUNDARY EXISTING CULVERT EXISTING PIPELINE + - + CUTOFF WALL ALIGNMENT ----- OVERHEAD ELECTRIC SURFACE DRAINAGE PROPOSED DEWATERING PIPE PROPOSED DISCHARGE PIPELINE PROPOSED RETURN PIPELINE PROPOSED CULVERT (NON-MINE DRAINAGE) PROPOSED SEEPAGE COLLECTION DRAIN PROPOSED STORMWATER DRAIN 0 PROPOSED MANHOLE PROPOSED RIP RAP • ROTASONIC BORING ◉ ROTASONIC BORING WITH PIEZOMETER \triangle SPT BORING SPT BORING WITH PACKER M FLOW METER

ABBREVIATIONS

APPROX.	-	APPROXIMATE
CDSM	-	CEMENT DEEP SOIL MIX
CMP	-	CORRUGATED METAL PIPE
CPEP	-	CORRUGATED POLYETHYLENE PIPE
CY	-	CUBIC YARD
DR	-	DIMENSION RATIO
DWG	-	DRAWING
EL.	-	ELEVATION
ø	_	DIAMETER
FTB	-	FLOTATION TAILINGS BASIN
GCL	_	GEOSYNTHETIC CLAY LINER
HDPE	-	HIGH DENSITY POLYETHYLENE
HRF	-	HYDROMETALLURGICAL RESIDUE FACILITY
LDPE	-	LOW DENSITY POLYETHYLENE
LF	-	LINER FEET
LTVSMC	-	LTV STEEL MINING COMPANY
MCY	-	MILLION CUBIC YARDS
mil	-	one thousandth of an inch
MIN	-	MINIMUM
MSL	-	MEAN SEA LEVEL
NTS	-	NOT TO SCALE
SCH.	-	SCHEDULE
DR	-	DIMENSION RATIO
TYP	-	TYPICAL
N-MH-XX	-	NORTH SECTION MANHOLE
NW-MH-XX	-	NORTHWEST SECTION MANHOLE
W-MH-XX	-	WEST SECTION MANHOLE
N-MH/PS-XX	-	NORTH SECTION MANHOLE/PUMP STATION
NW-MH/PS-XX	-	NORTHWEST SECTION MANHOLE

- WEST SECTION MANHOLE/PUMP STATION

W-MH/PS-XX

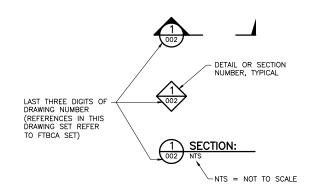
SHEET INDEX

SHEET NO. TITLE

GENERAL DRAWINGS

FTBCA-001	LOCATION MAP AND SITE MAP
FTBCA-002	LEGEND AND SHEET INDEX
FTBCA-003	PLAN SHEET LAYOUT
FTBCA-004	PLAN AND PROFILE - STATION 0+00 TO STATION 30+94
FTBCA-005	PLAN AND PROFILE - STATION 30+94 TO STATION 61+88
FTBCA-006	PLAN AND PROFILE - STATION 61+88 TO STATION 92+82
FTBCA-007	PLAN AND PROFILE - STATION 92+82 TO STATION 123+76
FTBCA-008	PLAN AND PROFILE- STATION 123+76 TO STATION 154+70
FTBCA-009	PLAN AND PROFILE - STATION 154+70 TO STATION 185+64
FTBCA-010	PLAN AND PROFILE- STATION 185+64 TO STATION 216+58
FTBCA-011	PLAN AND PROFILE - STATION 216+58 TO STATION 240+17
FTBCA-012	EAST SECTION PLAN & PROFILE STATION 0+00 TO STATION 25+43
FTBCA-013	DETAILS
FTBCA-014	DETAILS
FTBCA-015	DETAILS

DRAWING NUMBERING



GIGNATURE Thomas J. Radie

DATE 5/28/15 LICENSE# 20951

NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.
- 4. EXISTING TOPOGRAPHIC INFORMATION WAS UPDATED FOR AREAS SOUTH EAST OF COAL ASH LANDFILL AND EAST OF OUTCROP BETWEEN CELLS 1E AND 2E USING CONTOURS FROM DATA COLLECTED IN 1999.

PLANT DRAWING NUMBER:

FTB SEEPAGE CONTAINMENT AND STREAM AUGMENTATION SYSTEMS LEGEND AND SHEET INDEX

DESCRIPTION ISSUE STATUS A 09/28/12 WATER MANAGEMENT PLAN - PLANT- VERSION 2 - ATTACHEMENT B VERSION HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS REPEARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED POFFESSIONAL ENGINEER NUBER THE LAWS OF THE STATE OF ISSUED DATE 1 09/09/14 WATER MANAGEMENT PLAN - PLANT- VERSION 3 - ATTACHEMENT B DRAWN: FOR PERMITTING 2 12/31/14 WATER MANAGEMENT PLAN - PLANT- VERSION 3,4 - ATTACHEMENT B 5/28/15 3 5/28/15 ISSUED FOR PERMIT TO MINE APPLICATION CHECKED: RINTED NAME THOMAS J. RADUE FOR CONSTRUCTION BARR PROJECT NO.:

NOT APPROVED FOR CONSTRUCTION.

POLTMET

BDP

DVS/AMP

23/69-0029

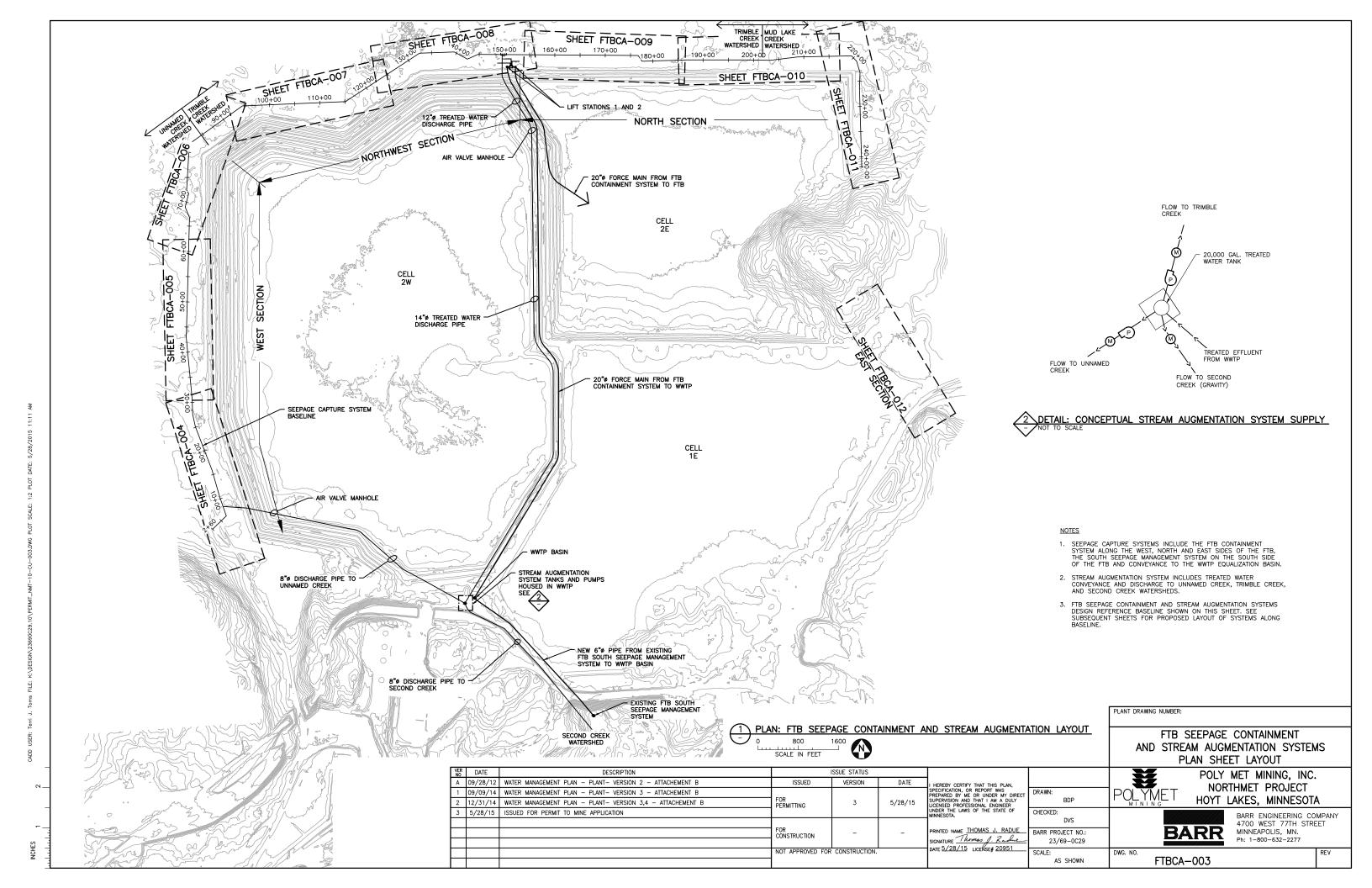
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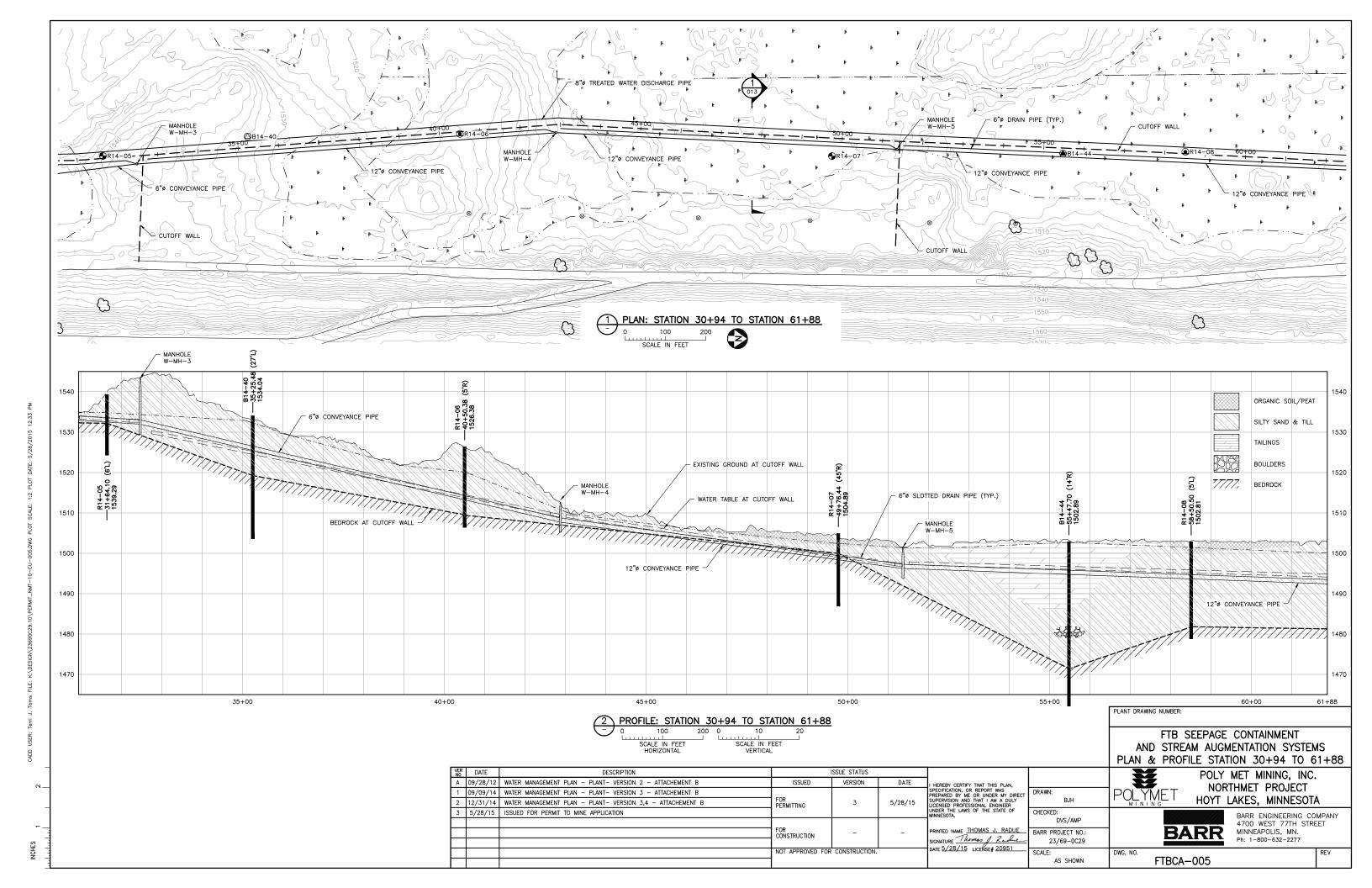
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

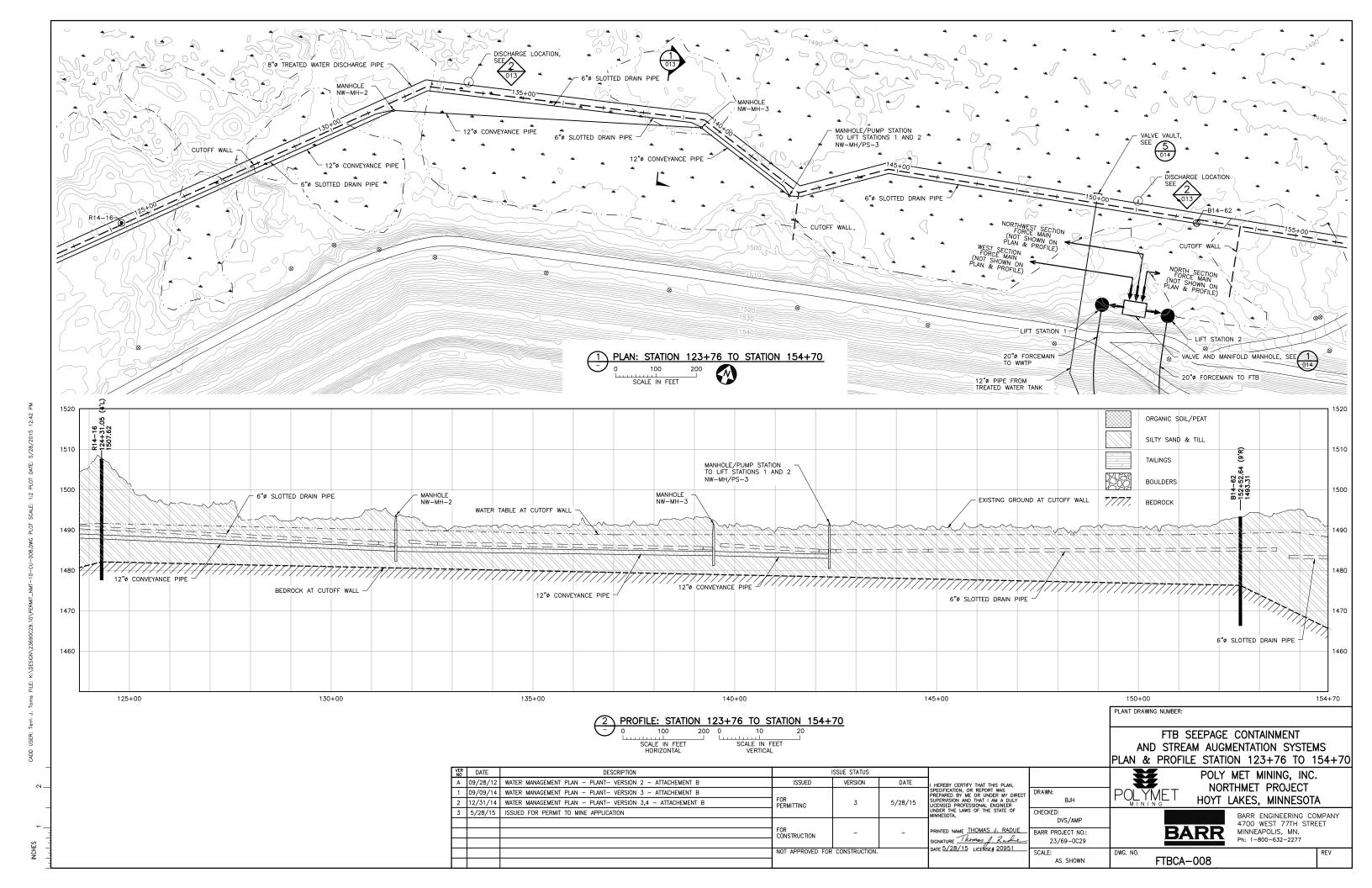


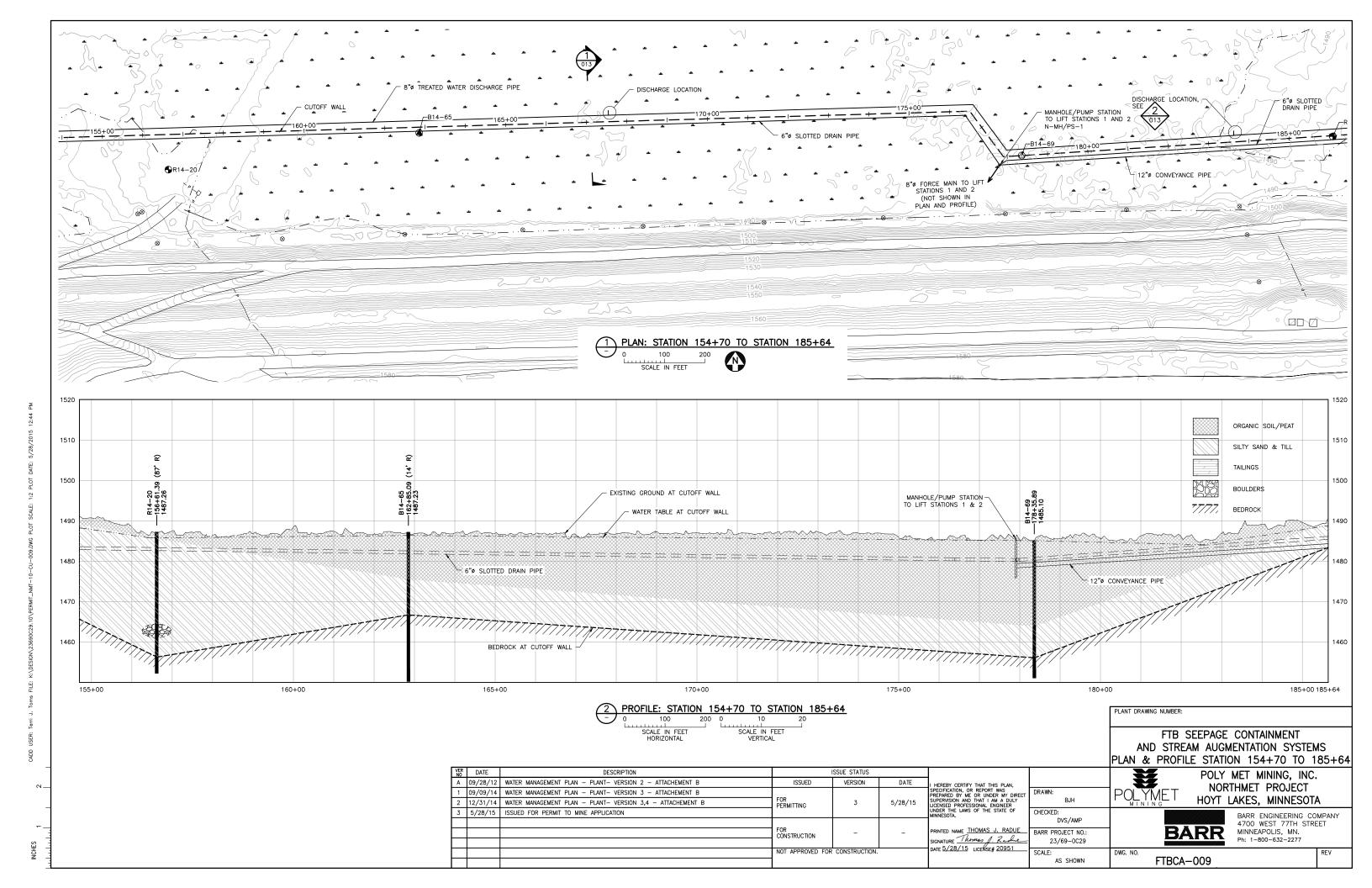
FTBCA-002

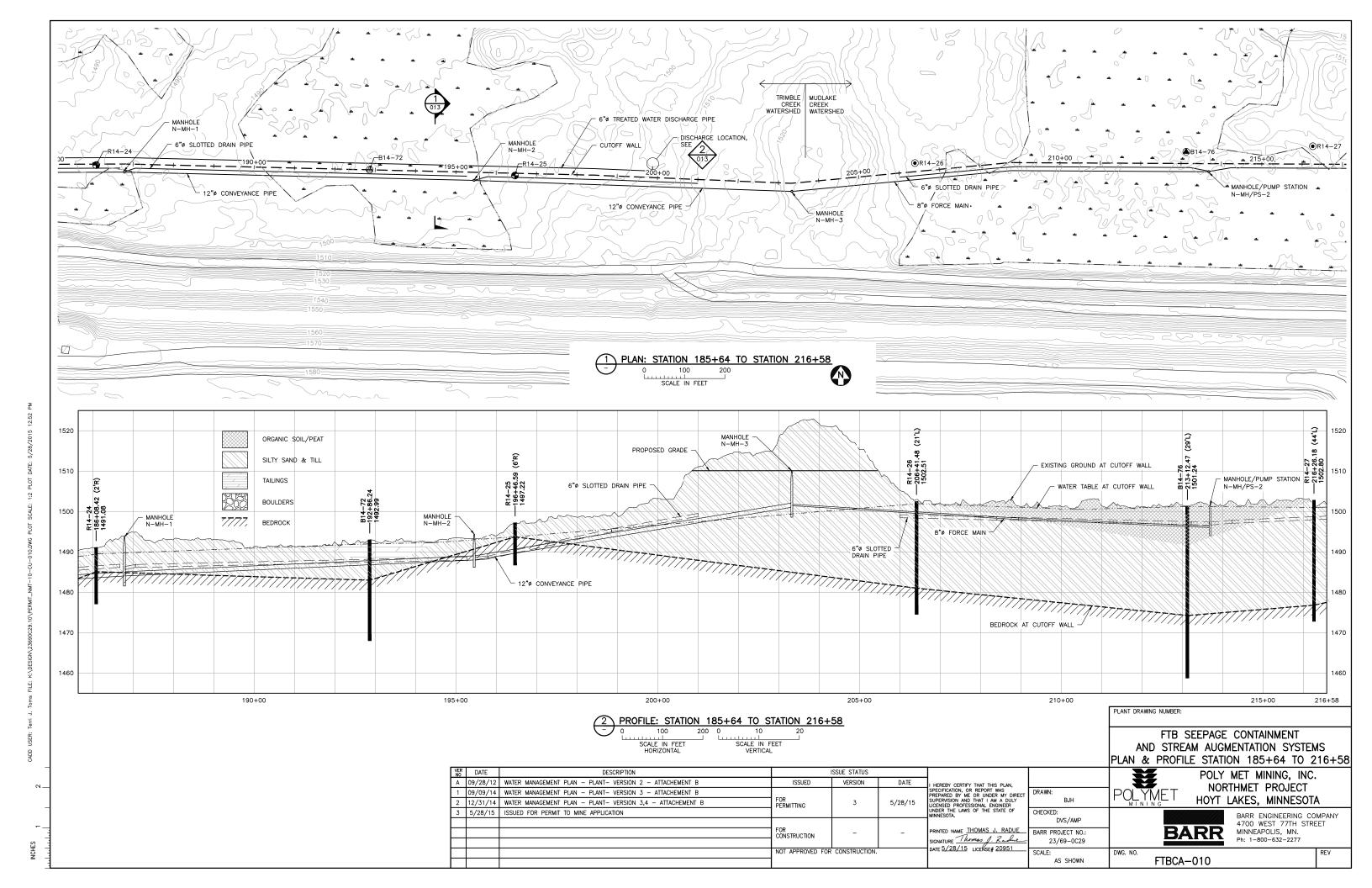
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

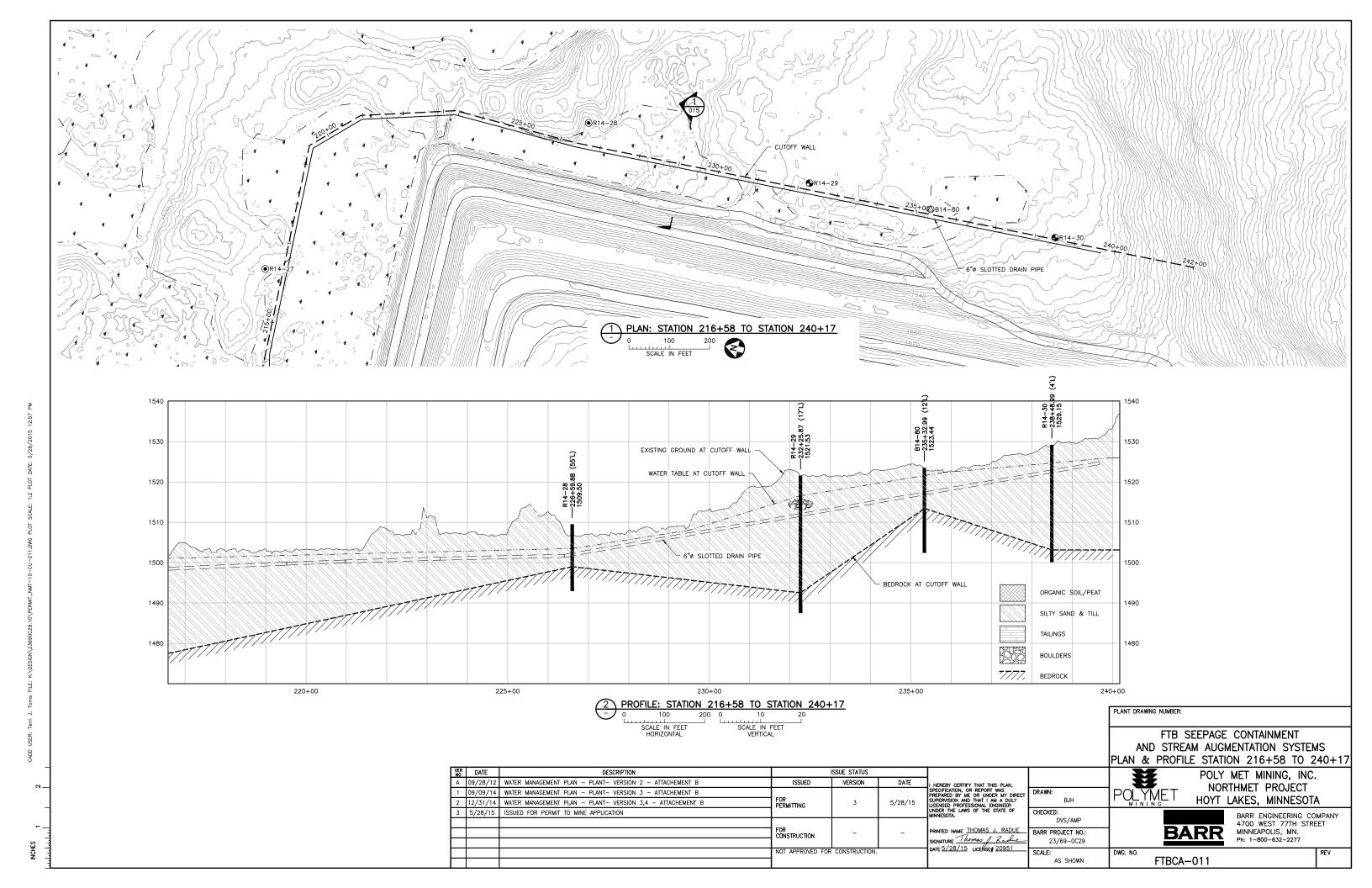


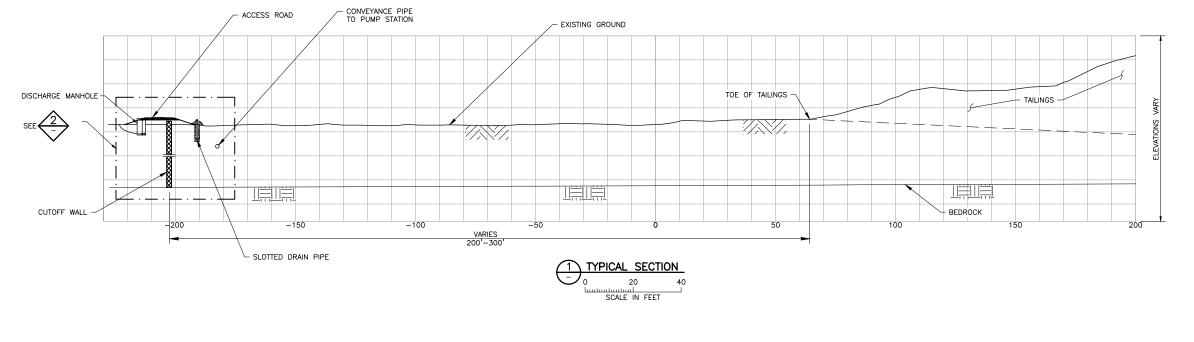


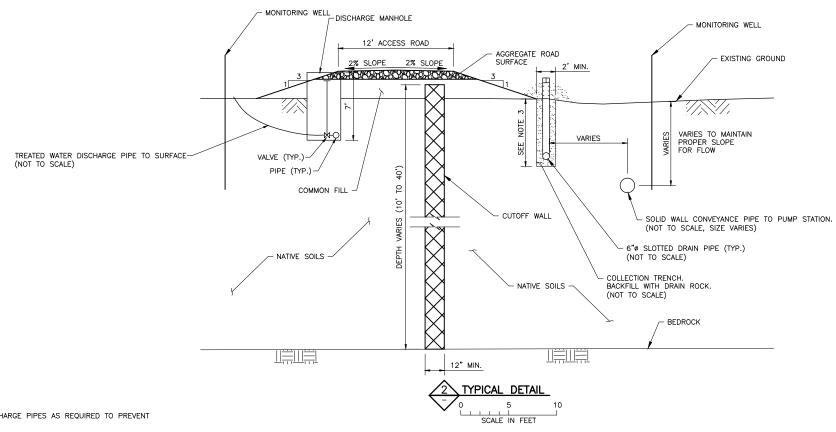












- 1. DIFFUSER TO BE INSTALLED ON DISCHARGE PIPES AS REQUIRED TO PREVENT EROSION.
- 2. CUTOFF WALL MAXIMUM DESIGN HYDRAULIC CONDUCTIVITY = 1×10^{-6} CM/SEC
- 3. 7' TYPICAL BUT MAY BE LESS IN AREAS WITH SHALLOW BEDROCK

PLANT DRAWING NUMBER:

AS SHOWN

FTB SEEPAGE CONTAINMENT AND STREAM AUGMENTATION SYSTEMS **DETAILS**

						_							
VER NO	DATE	DESCRIPTION	ISSUE STATUS										
Α	09/28/12	WATER MANAGEMENT PLAN - PLANT- VERSION 2 - ATTACHEMENT B	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.							
1	09/09/14	WATER MANAGEMENT PLAN - PLANT- VERSION 3 - ATTACHEMENT B	FOR PERMITTING	FOR PERMITTING	FOR PERMITTING			SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:				
2	12/31/14	WATER MANAGEMENT PLAN - PLANT- VERSION 3,4 - ATTACHEMENT B				FOR PERMITTING	FOR PERMITTING	FOR PERMITTING	FOR PERMITTING	FOR PERMITTING	FOR PERMITTING 3	5/28/15	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER
3	5/28/15	ISSUED FOR PERMIT TO MINE APPLICATION					UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:					
							DVS/AMP						
			FOR CONSTRUCTION			PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:						
						SIGNATURE Thomas J. Radie	23/69-0029						
			NOT APPROVED FOR	CONSTRUCTION.		DATE 5/28/15 LICENSE# 20951	SCALE:						

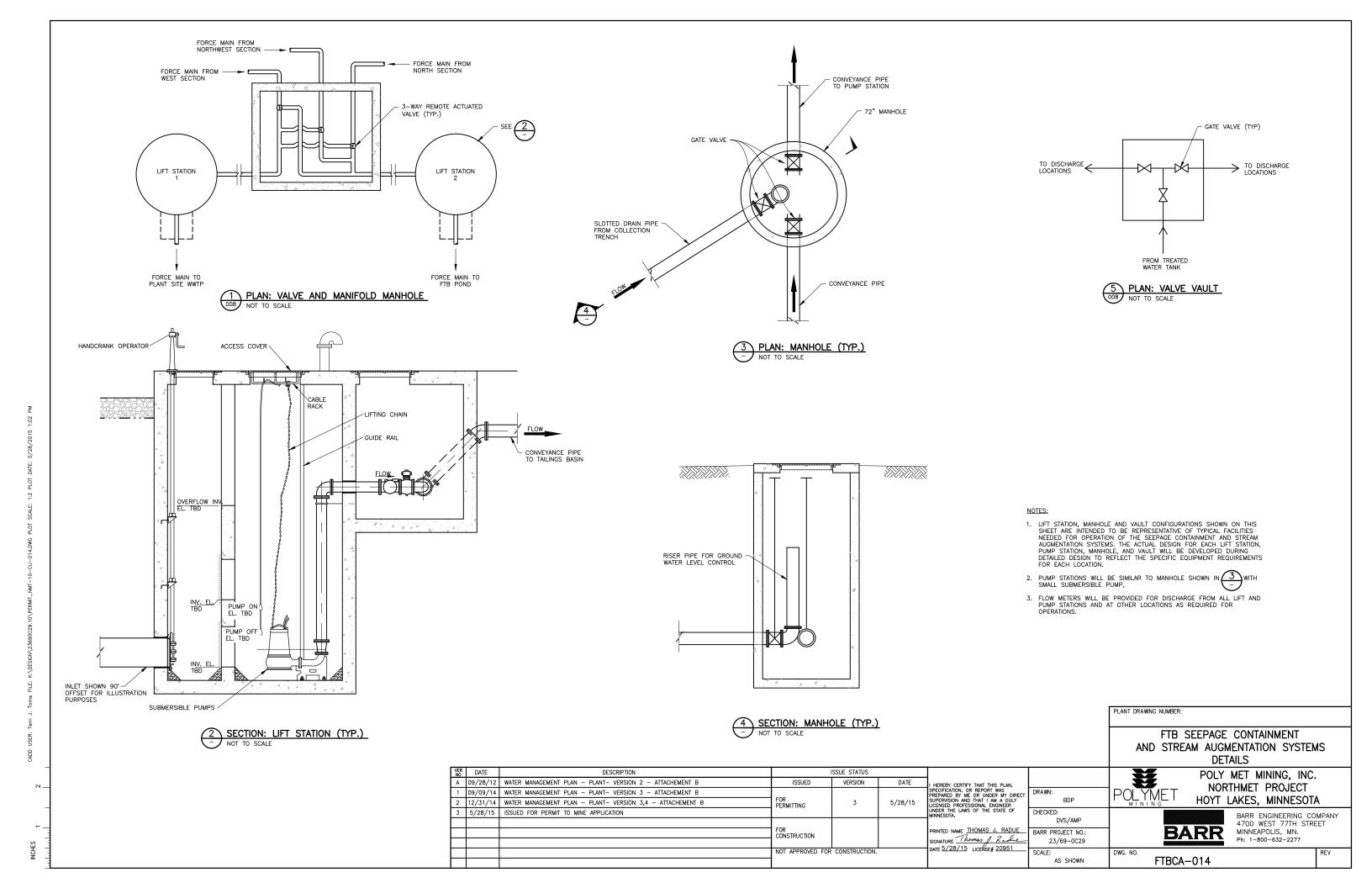
POLYMET **BARR**

HOYT LAKES, MINNESOTA

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

POLY MET MINING, INC. NORTHMET PROJECT

FTBCA-013



1700

1690

1680

1670

1660

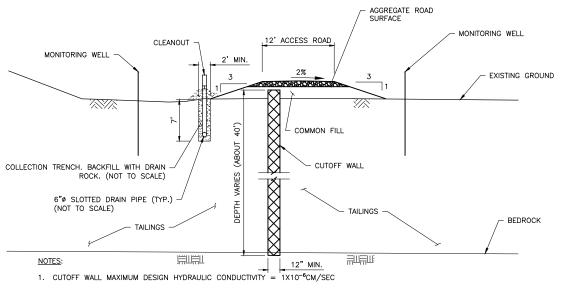
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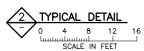
1640

1630

1620

7+010+15





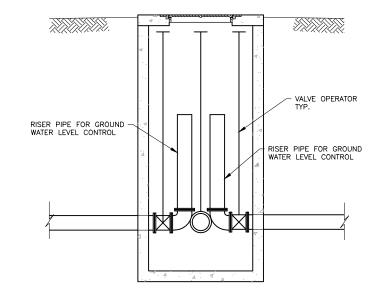
72" MANHOLE GATE VALVE -SLOTTED DRAIN PIPE SLOTTED DRAIN PIPE $^{oldsymbol{\perp}}$

PLAN: MANHOLE (TYP.)

NOT TO SCALE

CONVEYANCE PIPE TO LIFT STATION

- 1. LIFT STATION, MANHOLE AND VAULT CONFIGURATIONS SHOWN ON THIS SHEET ARE INTENDED TO BE REPRESENTATIVE OF TYPICAL FACILITIES NEEDED FOR OPERATION OF THE SEEPAGE CONTAINMENT SYSTEM. THE ACTUAL DESIGN FOR EACH LIFT STATION, PUMP STATION, MANHOLE, AND VAULT WILL BE DEVELOPED DURING DETAILED DESIGN TO REFLECT THE SPECIFIC EQUIPMENT REQUIREMENTS FOR EACH LOCATION.
- FLOW METERS WILL BE PROVIDED FOR DISCHARGE FROM ALL LIFT AND PUMP STATIONS AND AT OTHER LOCATIONS AS REQUIRED FOR OPERATIONS.



4 SECTION: MANHOLE (TYP.)

NOT TO SCALE

PLANT DRAWING NUMBER:

AS SHOWN

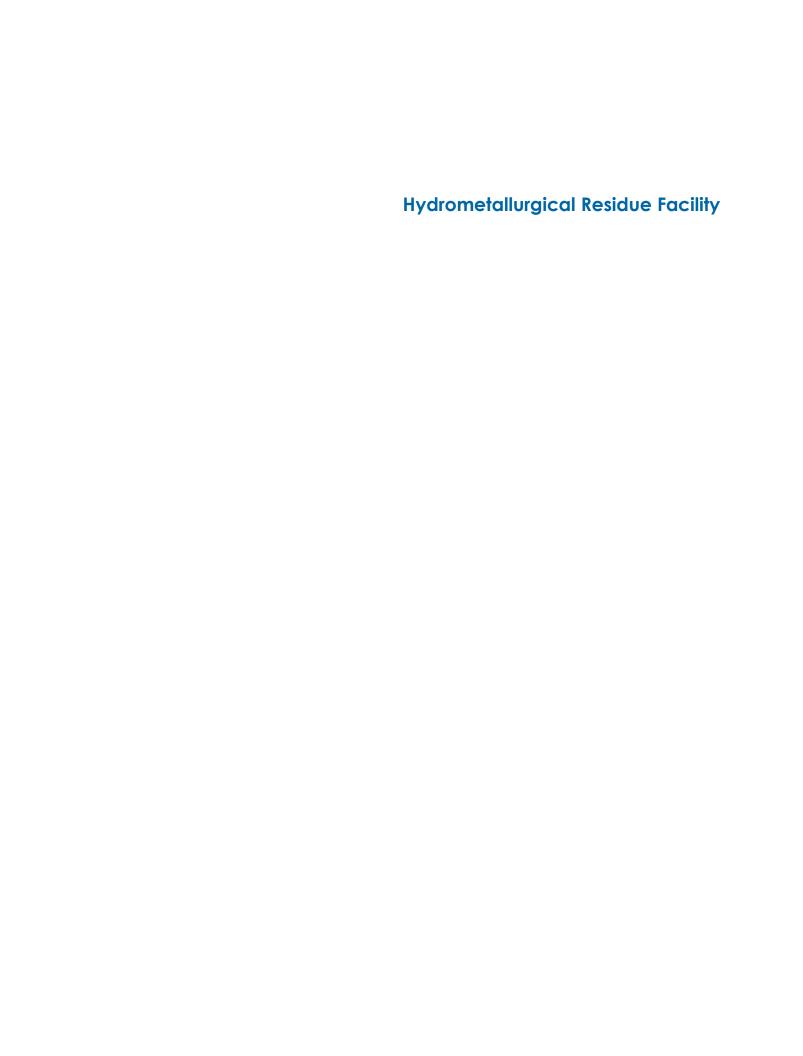
FTB SEEPAGE CONTAINMENT
AND STREAM AUGMENTATION SYSTEMS
DETAILS

POLY MET MINING, INC. NORTHMET PROJECT

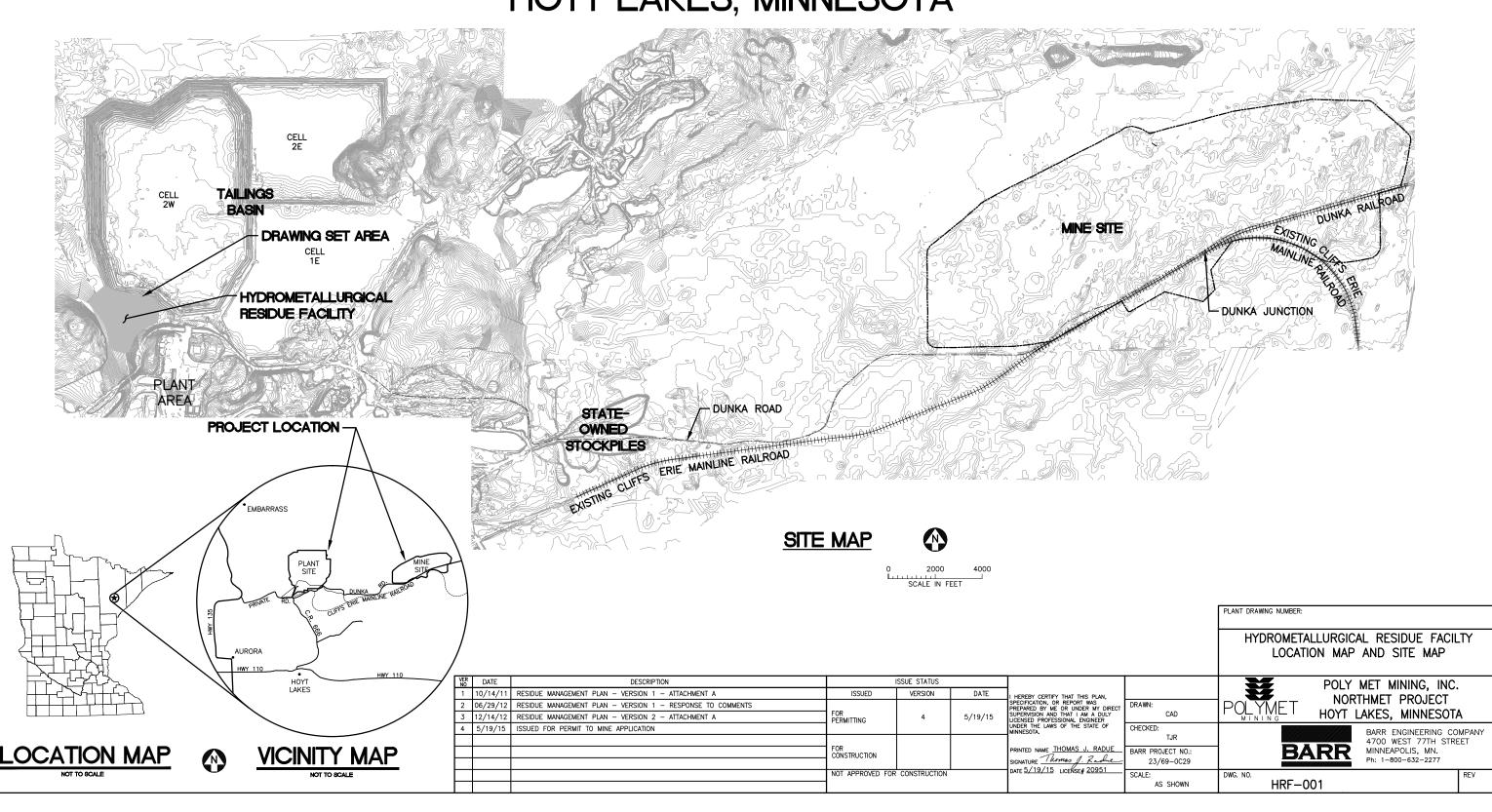
VER NO	DATE	DESCRIPTION	ISSUE STATUS				l							
Α	09/28/12	WATER MANAGEMENT PLAN - PLANT- VERSION 2 - ATTACHEMENT B	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.								
1	09/09/14	WATER MANAGEMENT PLAN - PLANT- VERSION 3 - ATTACHEMENT B				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:							
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3	5/28/15	ISSUED FOR PERMIT TO MINE APPLICATION				UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:							
							DVS/AMP							
			FOR CONSTRUCTION			PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:							
			00.10.11.0011011			SIGNATURE Thomas J. Radie	23/69-0C29							
			NOT APPROVED FOR CONSTRUCTION.		DATE 5/28/15 LICENSE# 20951	SCALE:								
			1				IAMOHS SV							

POLYMET HOYT LAKES, MINNESOTA BARR ENGINEERING COMPANY 4700 WEST 77TH STREET **BARR** MINNEAPOLIS, MN. Ph: 1-800-632-2277

FTBCA-015



POLY MET MINING, INC. NORTHMET PROJECT PERMIT SUPPORT DRAWINGS HYDROMETALLURGICAL RESIDUE FACILITY HOYT LAKES, MINNESOTA



GENERAL LEGEND

EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR — PROPOSED CONTOUR – MINOR EXISTING POWER POLE +++++++ EXISTING RAILROAD EXISTING ROAD ---- EXISTING TRAIL EXISTING UNIMPROVED TRAIL EXISTING STRUCTURES TREE LINE <u>14</u> WETLAND BOUNDARY EXISTING CULVERT EXISTING PIPELINE —ое— OVERHEAD ELECTRIC DISCHARGE POINT DEWATERING OUTLET POINT RETURN PUMP PAD DEWATERING PUMP SURFACE DRAINAGE DRAINAGE COLLECTION STRUCTURE AND PIPE DRAINAGE AREA BOUNDARY — PROPOSED DAMS PROPOSED DEWATERING PIPE ----- PROPOSED DISCHARGE PIPELINE PROPOSED RETURN PIPELINE PROPOSED CULVERT (NON-MINE DRAINAGE) PROPOSED SEEPAGE COLLECTION DRAIN -<- PROPOSED STORMWATER DRAIN 0 PROPOSED MANHOLE ---- PROPOSED WICK DRAIN LATERAL PIPE PROPOSED RIP RAP FILL SLOPE — CUT SLOPE

ABBREVIATIONS

APPROX. - APPROXIMATE CDSM - CEMENT DEEP SOIL MIX CMP - CORRUGATED METAL PIPE CPEP CORRUGATED POLYETHYLENE PIPE CUBIC YARD CY

DR DIMENSION RATIO DWG DRAWING EL. ELEVATION

 DIAMETER FTB FLOTATION TAILINGS BASIN

 GEOSYNTHETIC CLAY LINER GCL HDPE - HIGH DENSITY POLYETHYLENE HRF - HYDROMETALLURGICAL RESIDUE FACILITY

LDPE - LOW DENSITY POLYETHYLENE

LF LINER FEET

TYP.

LTVSMC - LTV STEEL MINING COMPANY MCY - MILLION CUBIC YARDS mil - one thousandth of an inch

 MINIMUM MIN MSL MEAN SEA LEVEL NOT TO SCALE SCH. - SCHEDULE DR DIMENSION RATIO

TYPICAL

SHEET INDEX

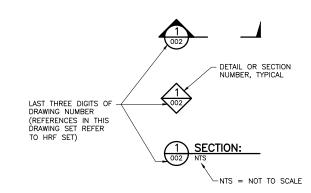
SHEET NO. TITLE

GENERAL DRAWINGS

GENERAL DRAWINGS

HRF-001 LOCATION MAP AND SITE MAP
HRF-002 LEGEND AND SHEET INDEX
HRF-003 EXISTING CONDITIONS
HRF-004 RESIDUE FACILITY LAYOUT - MINE YEAR 20
HRF-005 EMERGENCY BASIN EXCAVATIONS AND REMOVALS
HRF-006 SUBGRADE IMPROVEMENT AND SEEPAGE COLLECTION DRAIN LAYOUT
HRF-007 EMERGENCY BASIN PRELOAD
HRF-008 PHASE 1 LAYOUT
HRF-009 PHASE 2 LAYOUT
HRF-010 PHASE 2 LAYOUT
HRF-011 CROSS SECTIONS
HRF-011 CROSS SECTIONS
HRF-013 SUMP AND SIDE WALL RISER PLAN LAYOUT
HRF-014 SUMP AND SIDE WALL RISER SECTIONS
HRF-015 SUMP AND DIDE WALL RISER SECTIONS
HRF-016 TYPICAL SECTIONS AND DETAILS
HRF-017 PIPING PLAN AND PROFILE
HRF-018 PIPING DETAILS HRF-017 PIPING PLAN AND PROFILE
HRF-018 PPING DETAILS
HRF-019 RETURN WATER PUMP RAFT
HRF-020 CLOSURE PREPARATION PLAN
HRF-021 TEMPORARY COVER AND FINAL COVER GRADING
HRF-022 FINAL CLOSURE GRADING AND DEAINAGE
HRF-023 CLOSURE SECTIONS AND DETAILS
HRF-024 GEOTECHNICAL INSTRUMENTATION DETAILS

DRAWING NUMBERING



NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.

PLANT DRAWING NUMBER:

POLYMET

HYDROMETALLURGICAL RESIDUE FACILTY LEGEND AND SHEET INDEX

BARR

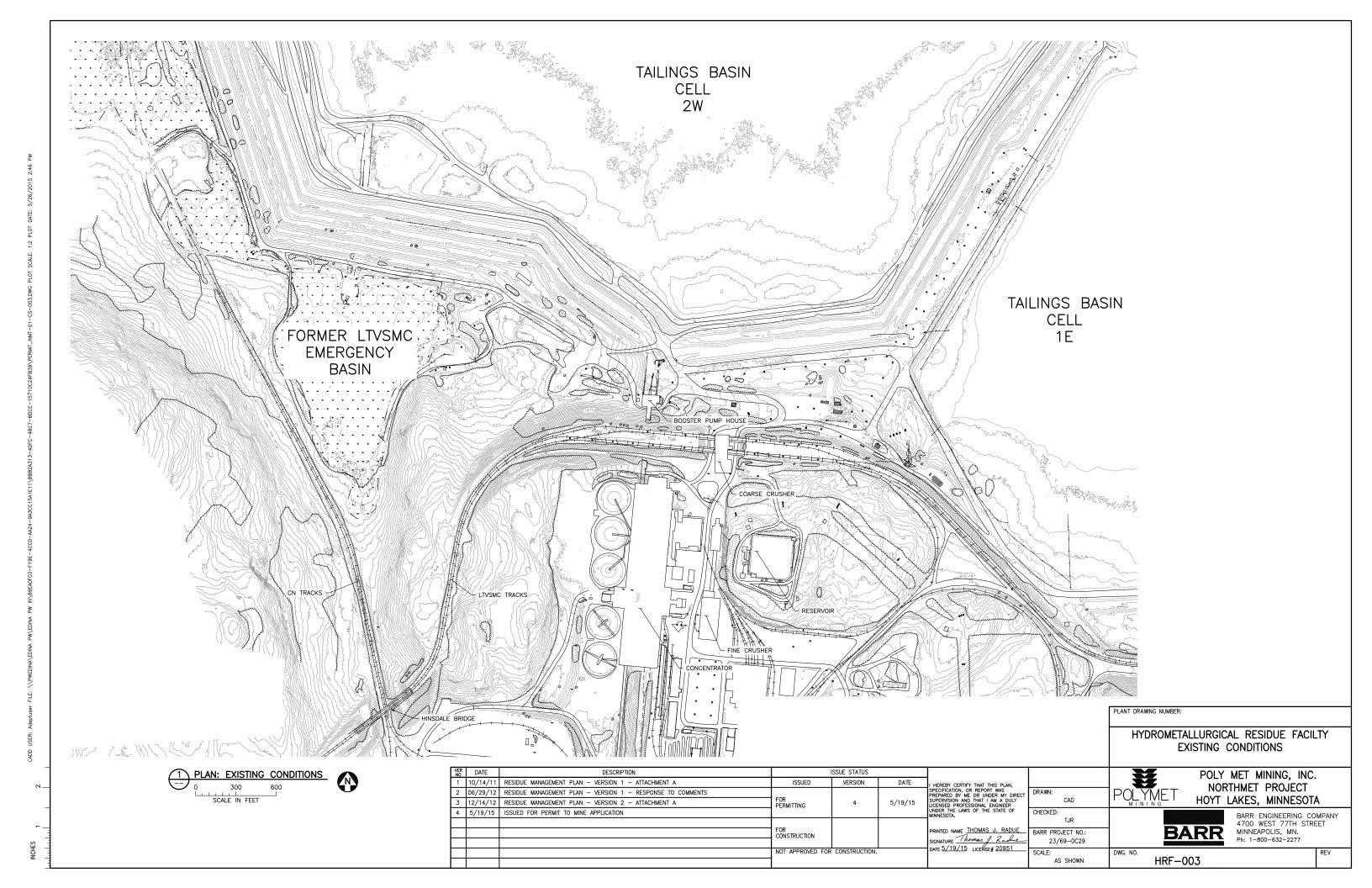
HRF-002

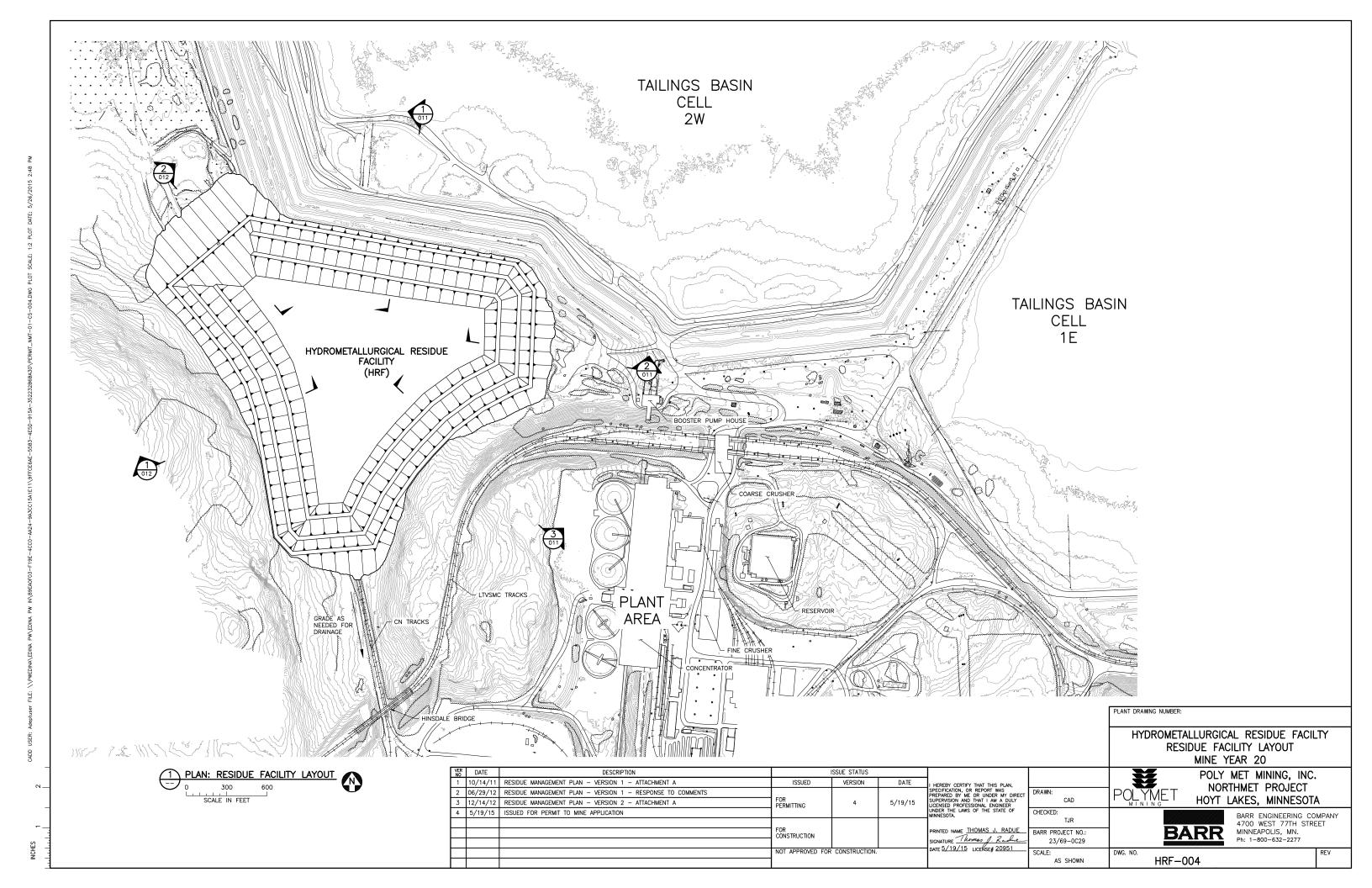
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2	06/29/12	RESIDUE MANAGEMENT PLAN - VERSION 1 - RESPONSE TO COMMENTS				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:							
3	12/14/12	RESIDUE MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A	FOR PERMITTING									1 3/19/13 1	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	CAD
4	5/19/15	ISSUED FOR PERMIT TO MINE APPLICATION				UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:							
						1	TJR							
			FOR CONSTRUCTION				PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:						
]			SIGNATURE Thomas J. Radie	23/69-0029							
			NOT APPROVED FOR CONSTRUCTION.		-	DATE 5/19/15 LICENSE# 20951	SCALE:							
			1				AS SHOWN							

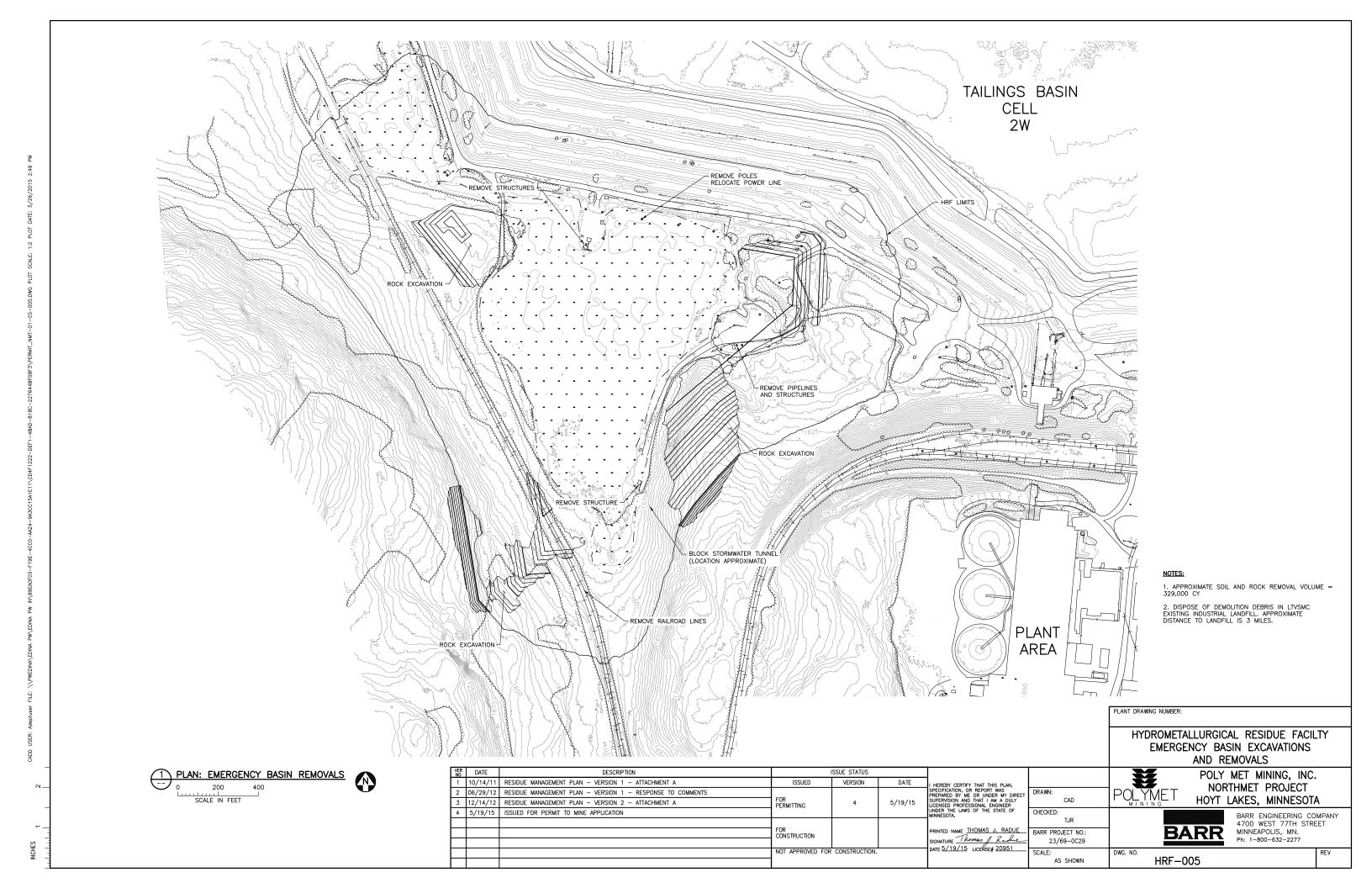
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

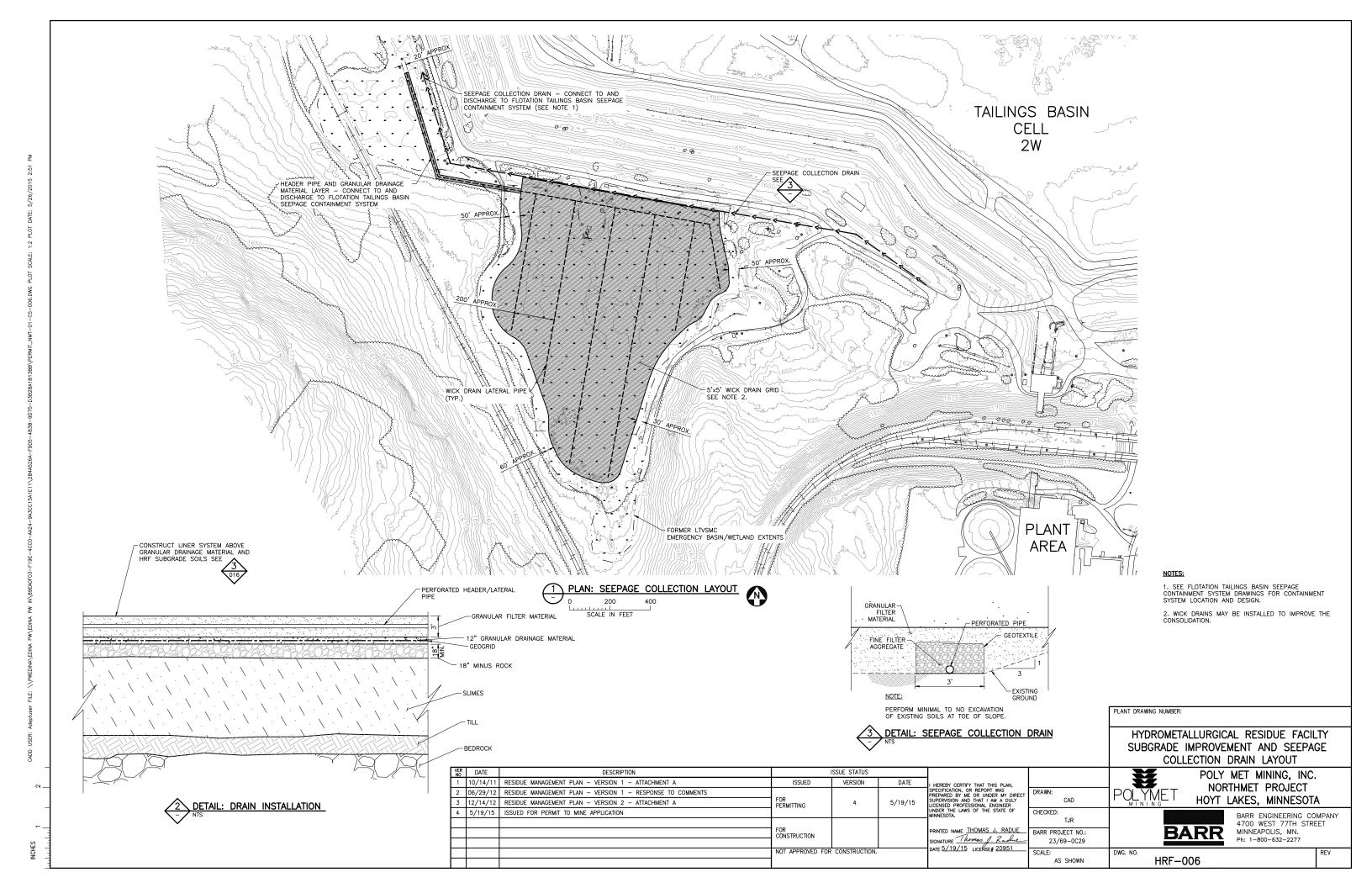
POLY MET MINING, INC. NORTHMET PROJECT

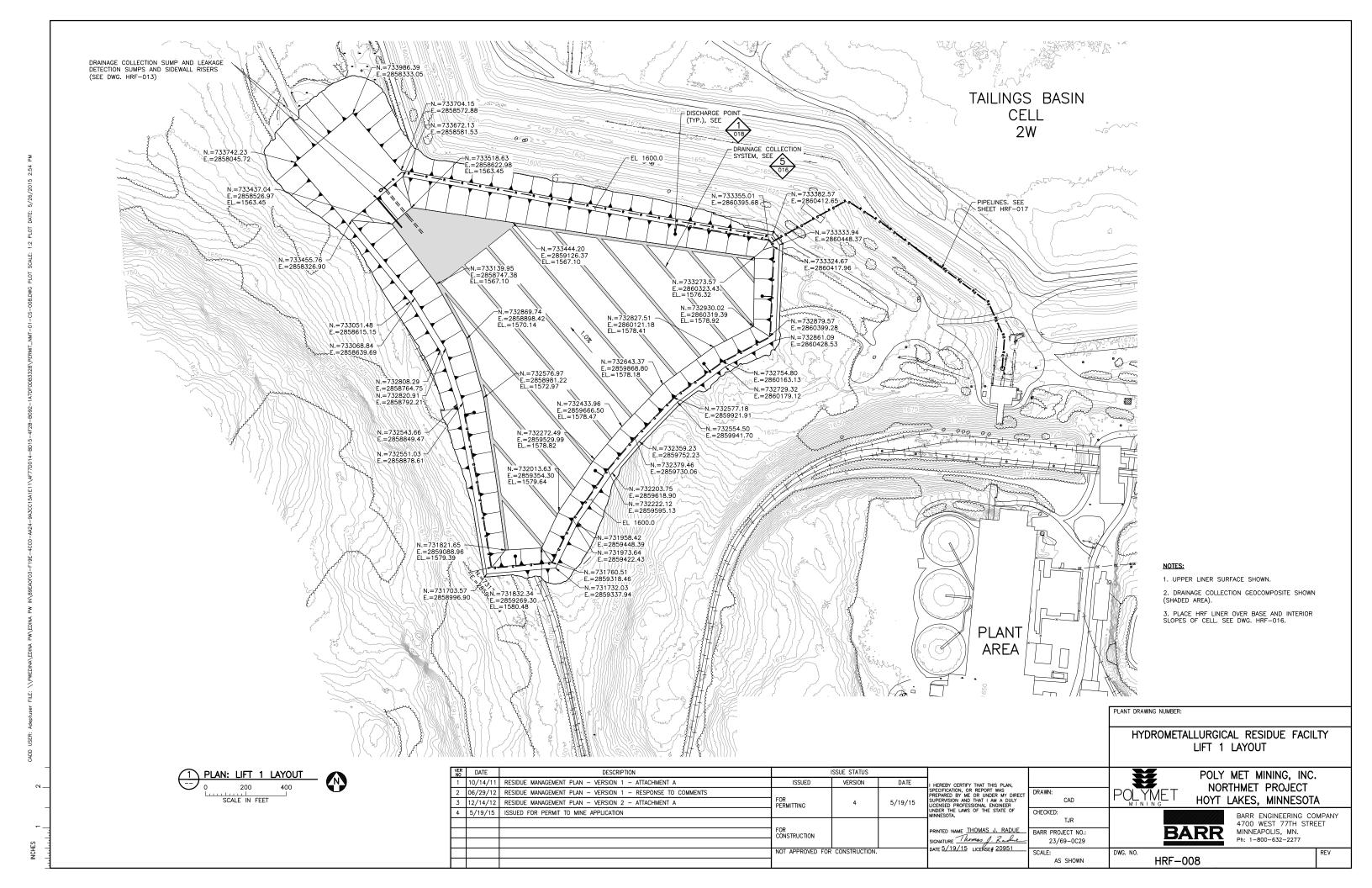
HOYT LAKES, MINNESOTA

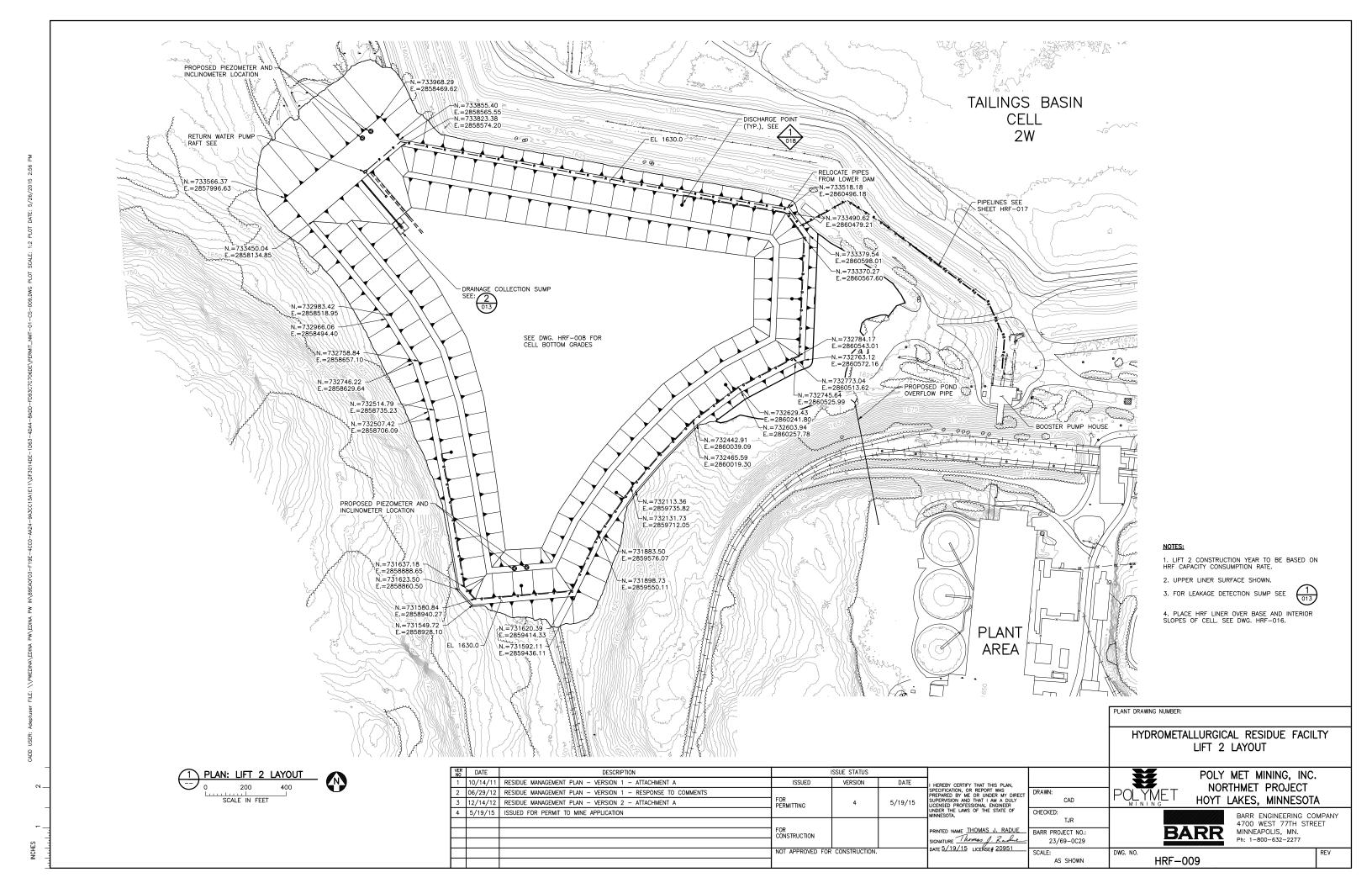


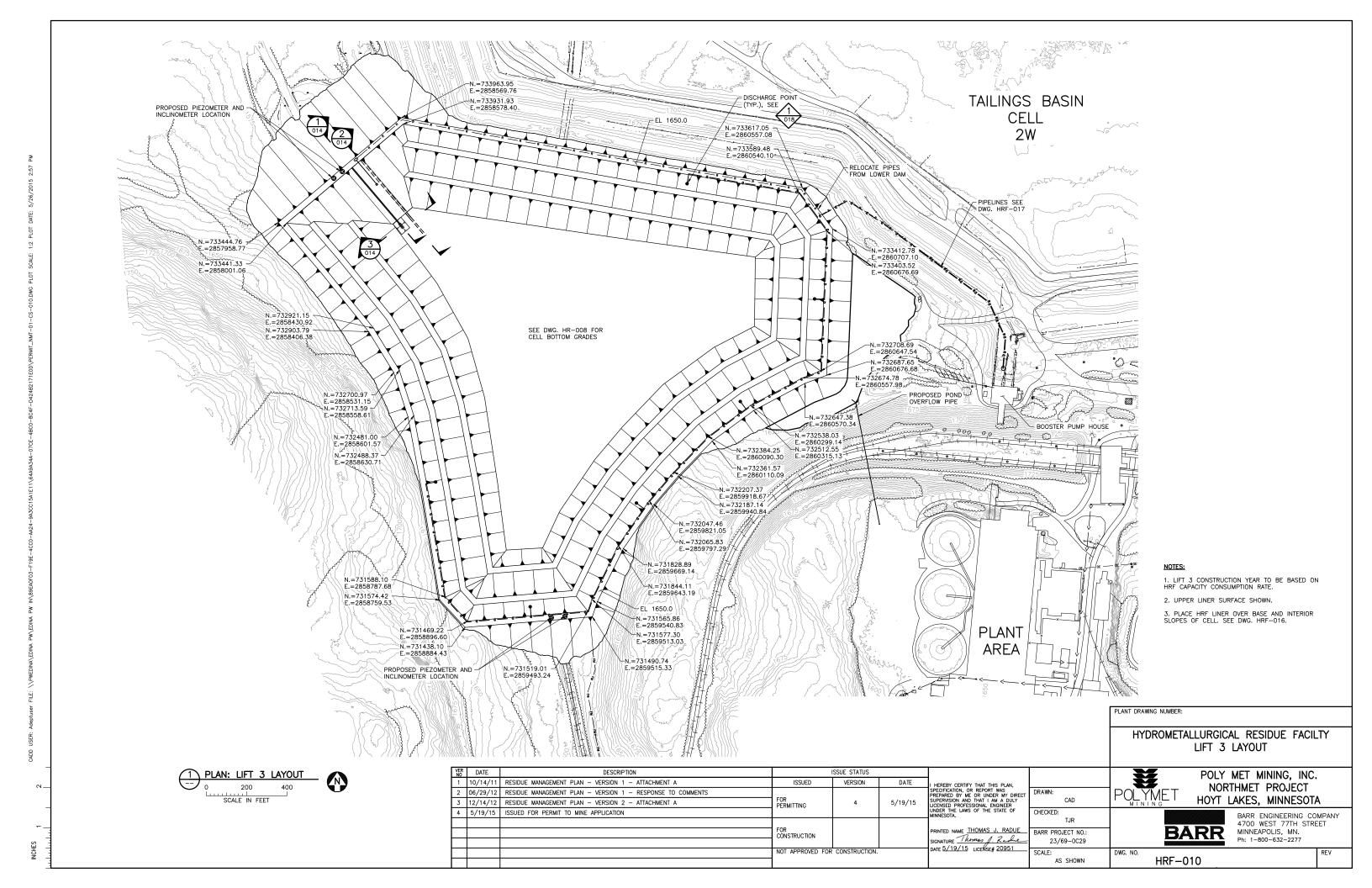


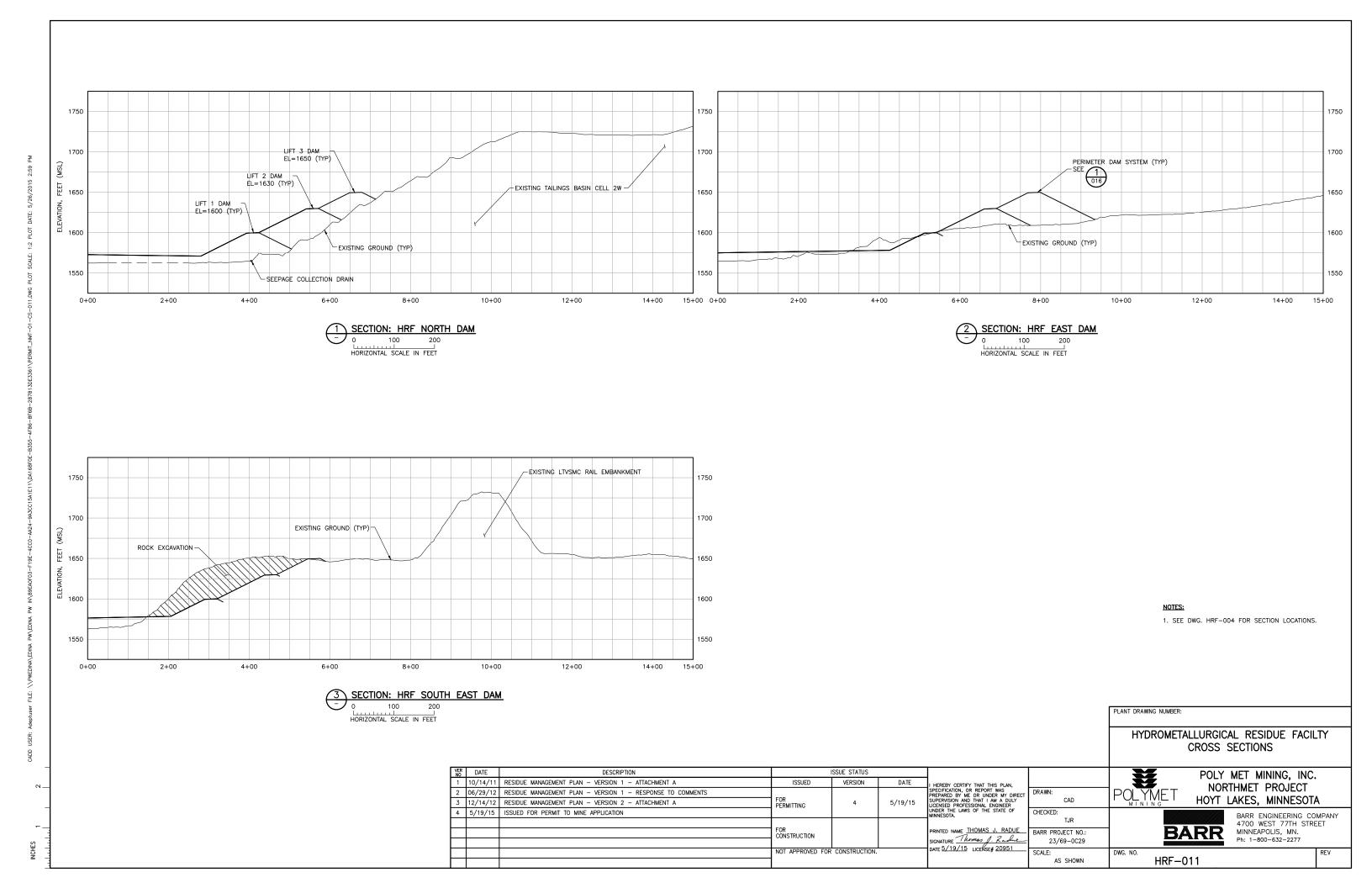


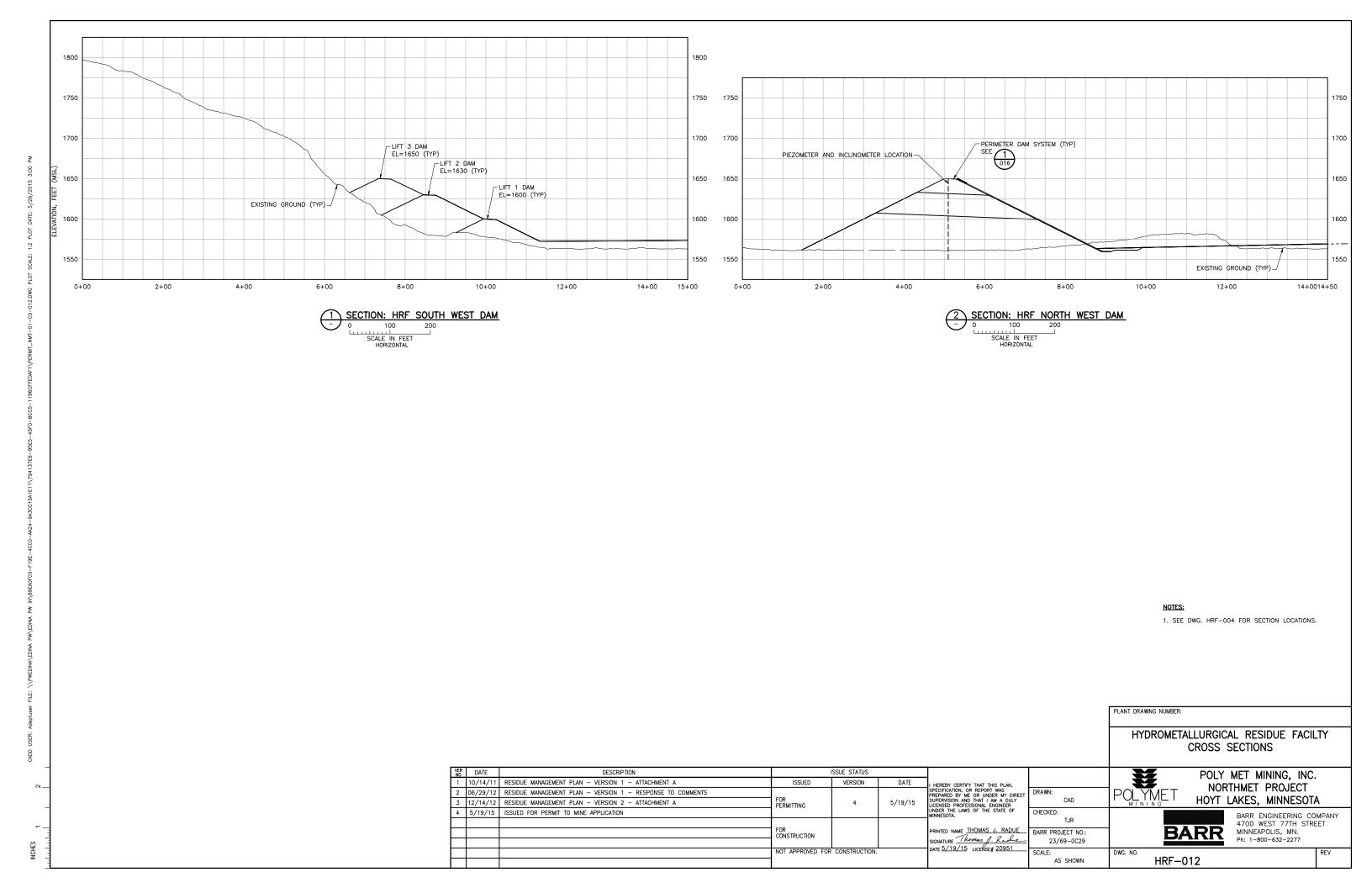


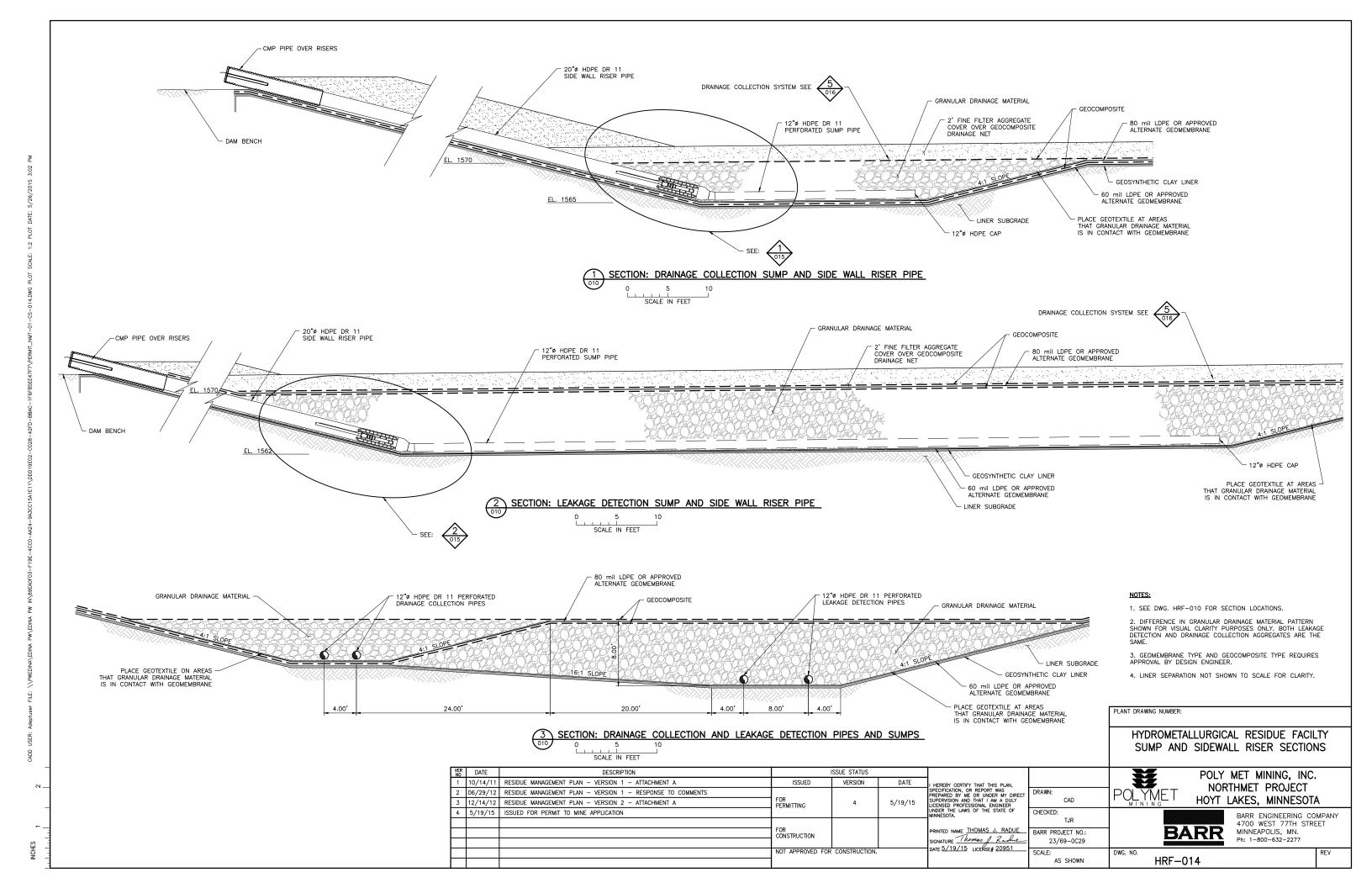


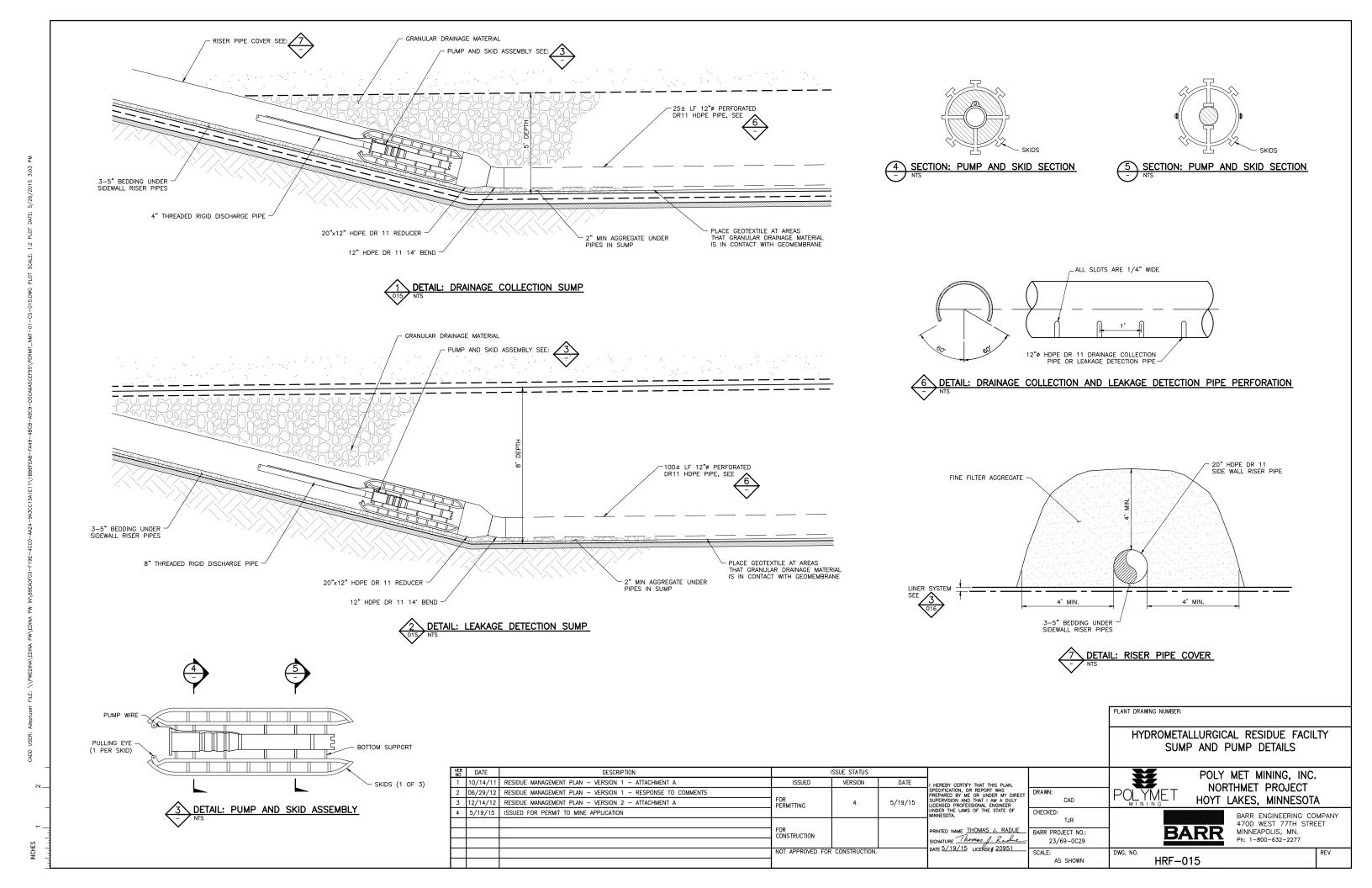


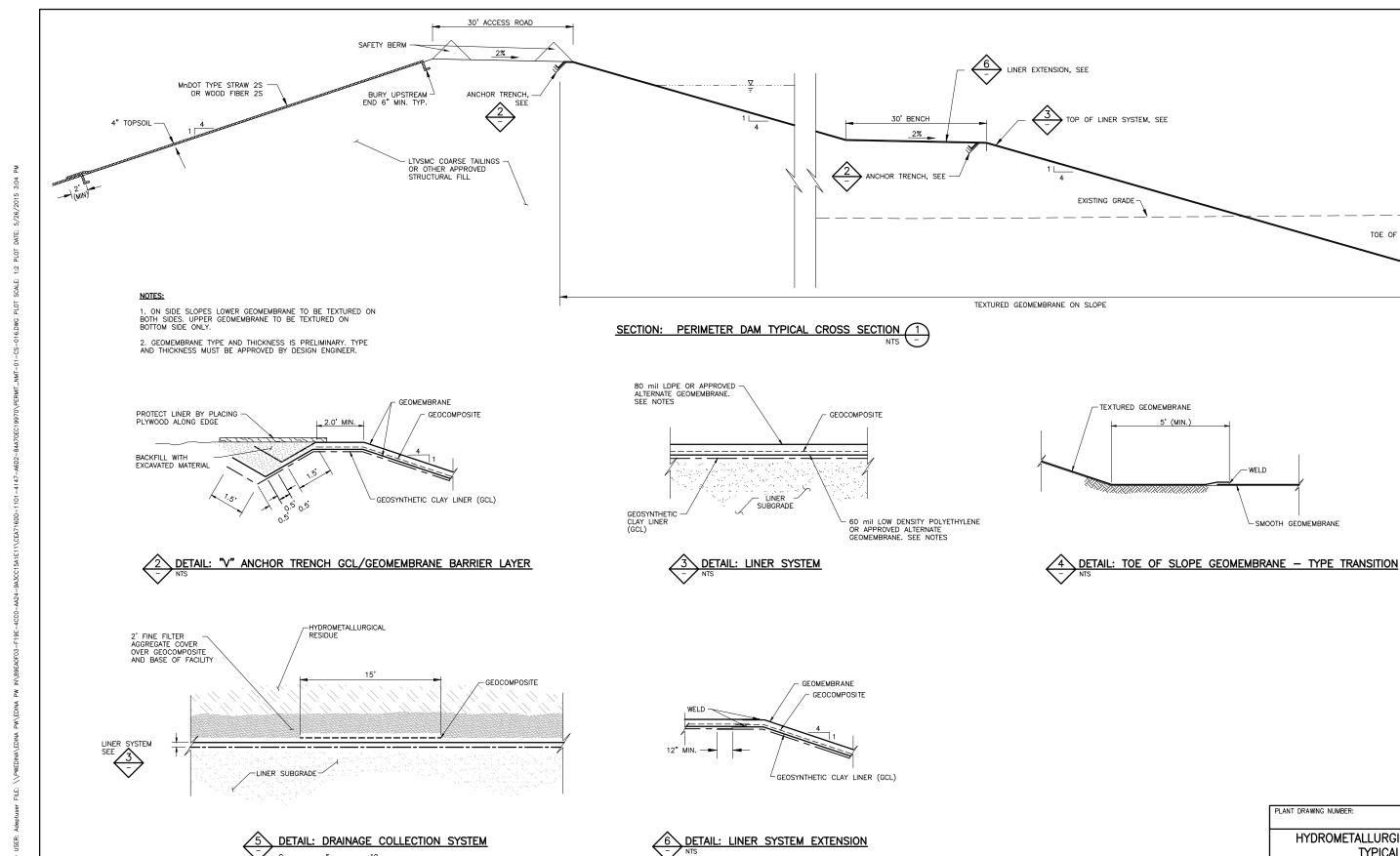












PLANT DRAWING NUMBER:

POLYMET

HRF-016

CAD

TJR

23/69-0029

AS SHOWN

HYDROMETALLURGICAL RESIDUE FACILTY TYPICAL SECTIONS AND DETAILS

TOE OF SLOPE TRANSITION

SMOOTH GEOMEMBRANE

DESCRIPTION ISSUE STATUS HEREBY CERTIFY THAT THIS PLAN, PECIFICATION, OR REPORT WAS REPARED BY ME OR UNDER MY DIRECT LUPERVISION AND THAT I AM A DULY CICRISCD PROFESSIONAL ENGINEER NOER THE LAWS OF THE STATE OF HINDEST AT THE LAWS OF THE STATE OF THE 1 10/14/11 RESIDUE MANAGEMENT PLAN - VERSION 1 - ATTACHMENT A ISSUED VERSION DATE 2 06/29/12 RESIDUE MANAGEMENT PLAN - VERSION 1 - RESPONSE TO COMMENTS DRAWN: FOR PERMITTING 3 12/14/12 RESIDUE MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A 4 5/19/15 ISSUED FOR PERMIT TO MINE APPLICATION CHECKED: PRINTED NAME <u>THOMAS J. RADUE</u> SIGNATURE *Thomas J. Radue* FOR CONSTRUCTION BARR PROJECT NO.: DATE 5/19/15 LICENSE# 20951 NOT APPROVED FOR CONSTRUCTION.

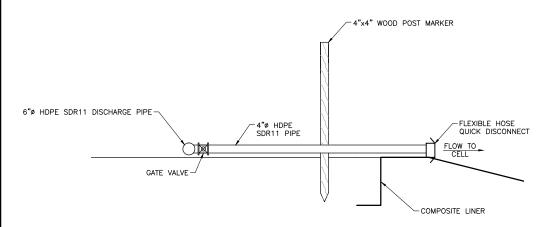
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET **BARR** MINNEAPOLIS, MN. Ph: 1-800-632-2277

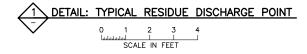
POLY MET MINING, INC.

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

SCALE IN FEET





1. PIPE SIZES ARE PRELIMINARY.

PLANT DRAWING NUMBER:

HYDROMETALLURGICAL RESIDUE FACILTY PIPING DETAILS

VER NO	DATE	DESCRIPTION	ISSUE STATUS				
1	10/14/11	RESIDUE MANAGEMENT PLAN - VERSION 1 - ATTACHMENT A	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.	
2	06/29/12	RESIDUE MANAGEMENT PLAN - VERSION 1 - RESPONSE TO COMMENTS			l	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:
3	12/14/12	RESIDUE MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A	FOR PERMITTING	4		SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.	CAD
4	5/19/15	ISSUED FOR PERMIT TO MINE APPLICATION					CHECKED:
							TJR
			FOR CONSTRUCTION			PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:
			CONSTRUCTION			SIGNATURE Thomas J. Radie	23/69-0029
			NOT APPROVED FOR	CONSTRUCTION.		DATE 5/19/15 LICENSE# 20951	SCALE:
			1				AS SHOWN

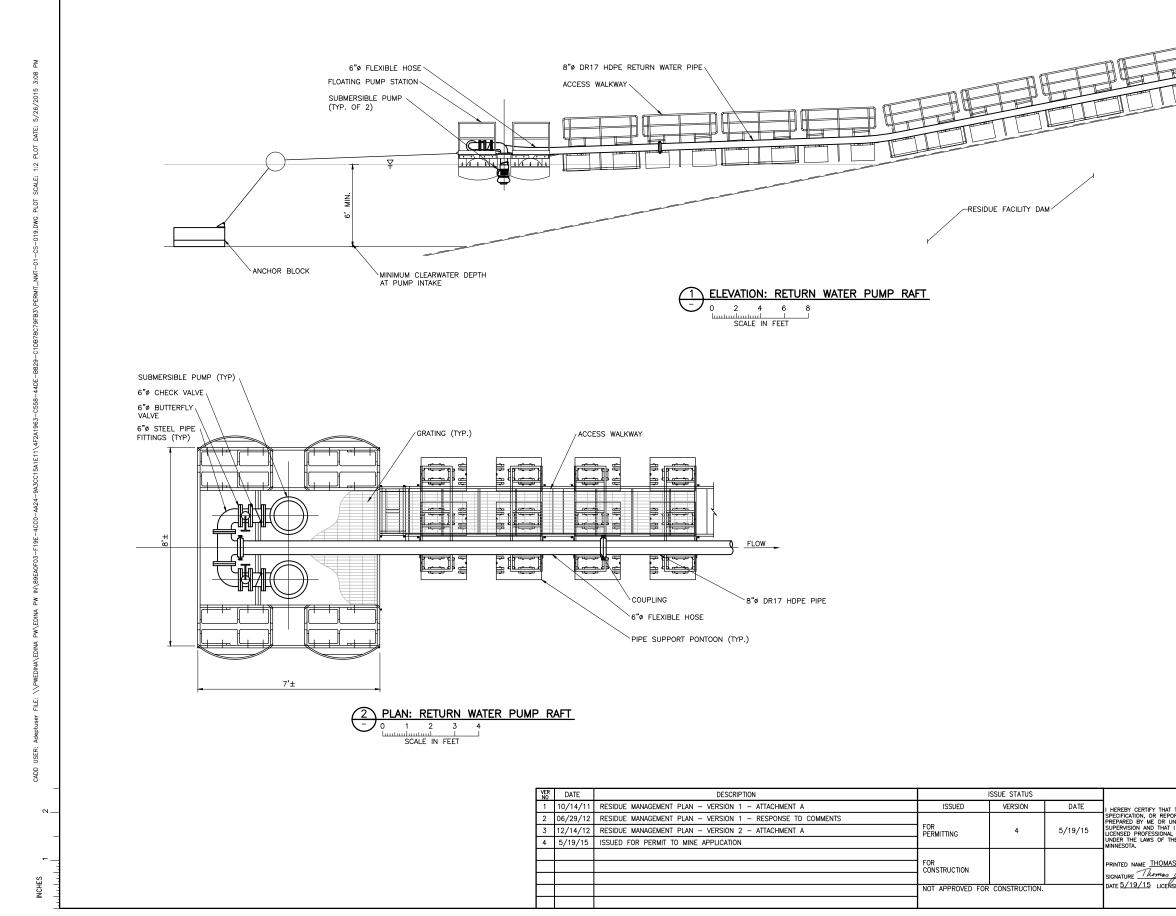
POLYMET MINING

AS SHOWN

POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR ENGINEERING COMPANY
4700 WEST 77TH STREET
MINNEAPOLIS, MN.
Ph: 1-800-632-2277

HRF-018



RETURN FLOW TO HYDROMET PLANT ANCHOR BLOCK - PROTECT LINER BY PLACING GEOTEXTILE UNDER PONTOONS

PLANT DRAWING NUMBER:

POLYMET

HYDROMETALLURGICAL RESIDUE FACILTY RETURN WATER PUMP RAFT

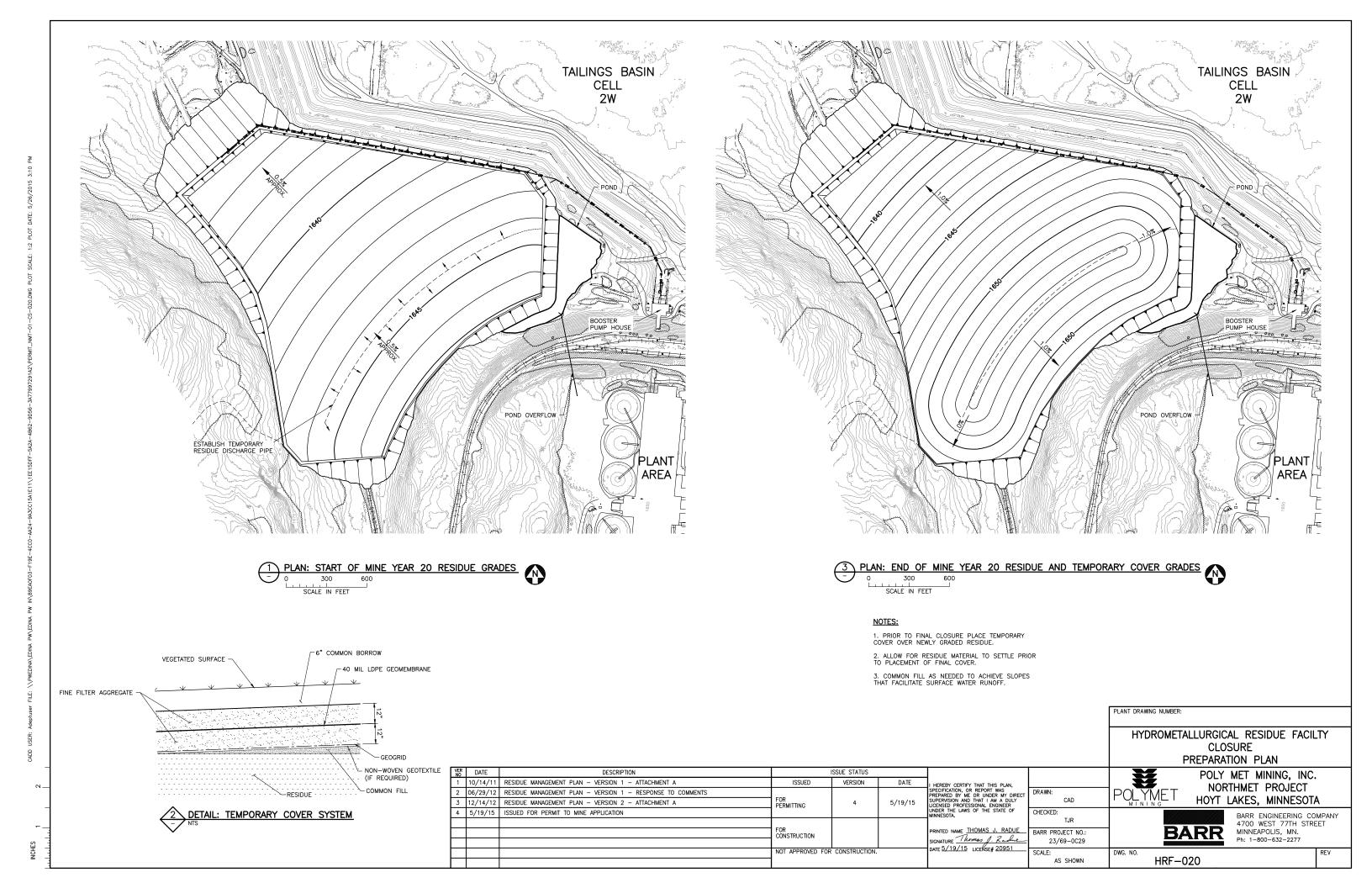
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2	06/29/12	RESIDUE MANAGEMENT PLAN - VERSION 1 - RESPONSE TO COMMENTS				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:
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4	5/19/15	ISSUED FOR PERMIT TO MINE APPLICATION					CHECKED:
						1	TJR
			FOR CONSTRUCTION			PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:
			001131110011011			SIGNATURE Thomas J. Radie	23/69-0C29
			NOT APPROVED FOR	ED FOR CONSTRUCTION.		DATE 5/19/15 LICENSE# 20951	SCALE:
			1				AS SHOWN

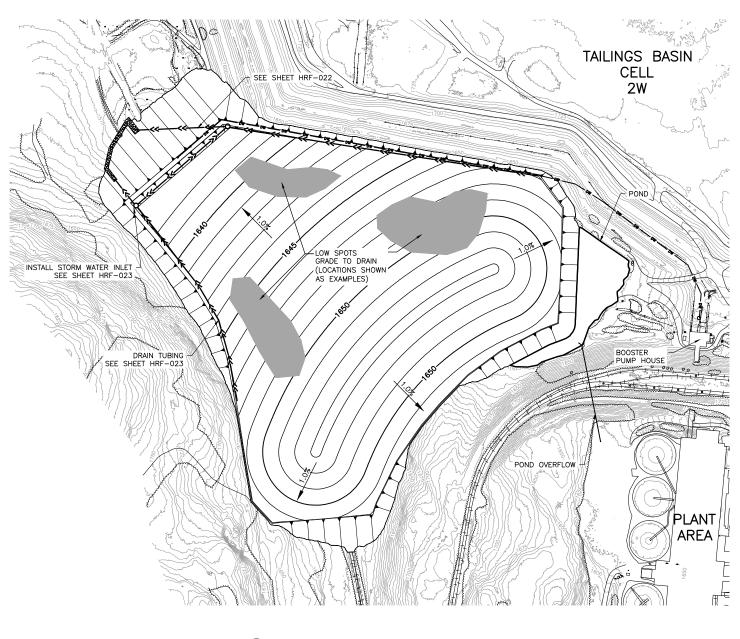
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277 **BARR**

HRF-019

POLY MET MINING, INC. NORTHMET PROJECT

HOYT LAKES, MINNESOTA





TAILINGS BASIN CELL POND OVERFLOW PLANT AREA PLAN: FINAL COVER GRADES

O 300 600
SCALE IN FEET

PLAN: TEMPORARY COVER REGRADING

O 300 600

SCALE IN FEET

NOTES:

1. PRIOR TO FINAL CLOSURE GRADE ANY LOW SPOTS CREATED DURING SETTLEMENT ALLOTMENT TIME.

2. INSTALL DRAIN TUBING AND SURFACE WATER INLETS.

PLANT DRAWING NUMBER:

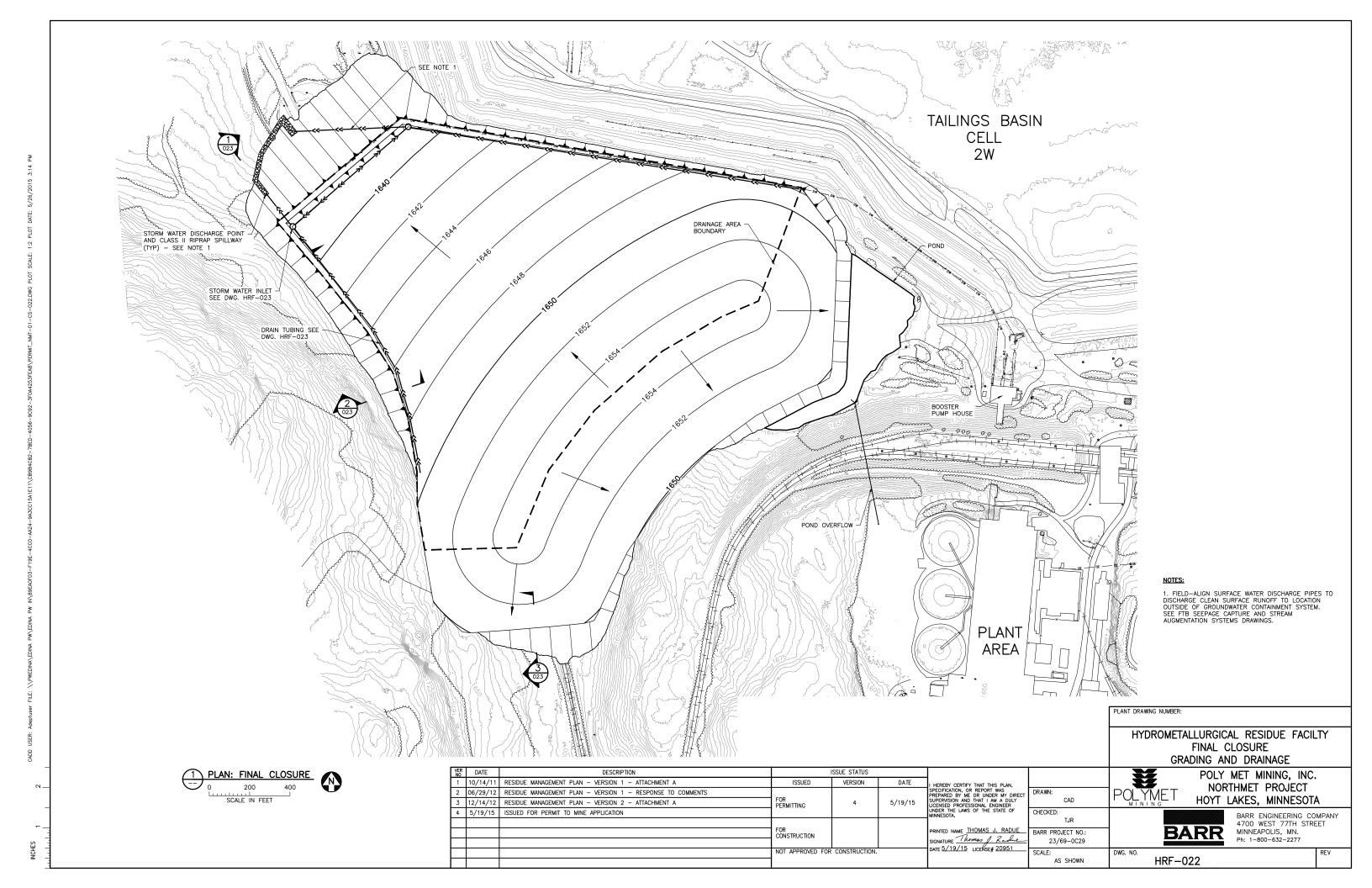
HYDROMETALLURGICAL RESIDUE FACILTY TEMPORARY COVER AND FINAL COVER GRADING

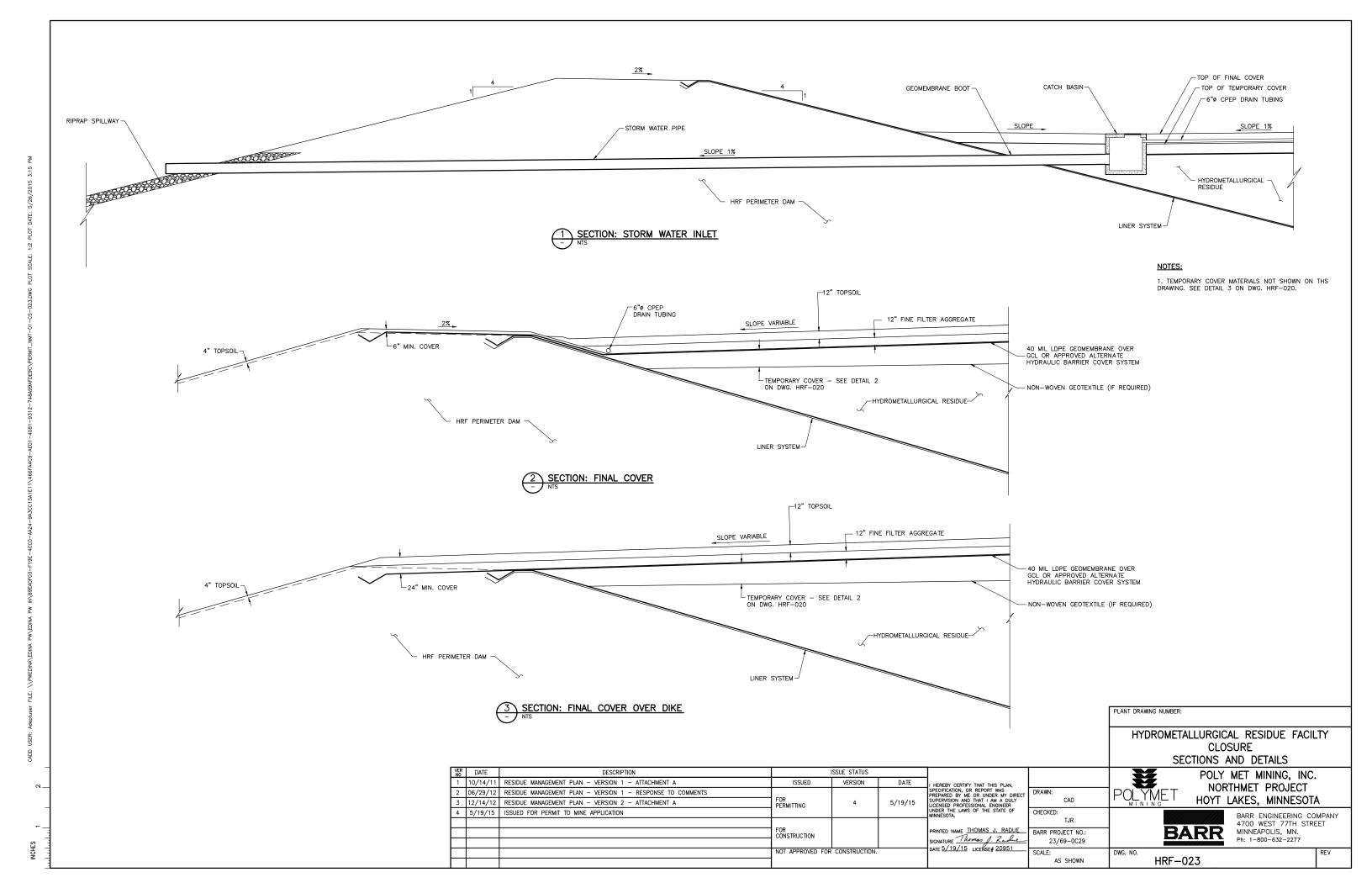
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						1	TJR
Г			FOR CONSTRUCTION			PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:
Г			CONSTRUCTION			SIGNATURE Thomas J. Radie	23/69-0C29
Г			NOT APPROVED FOR CONSTRUC			DATE 5/19/15 LICENSE# 20951	SCALE:
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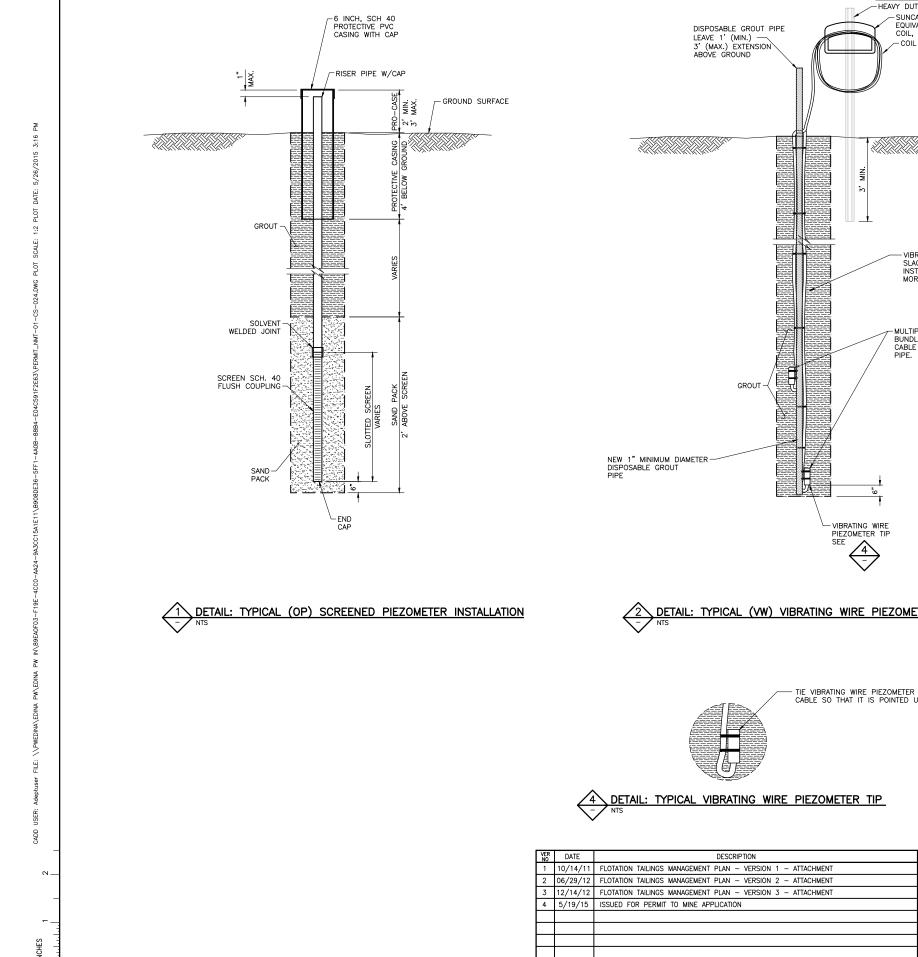
POLYMET POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

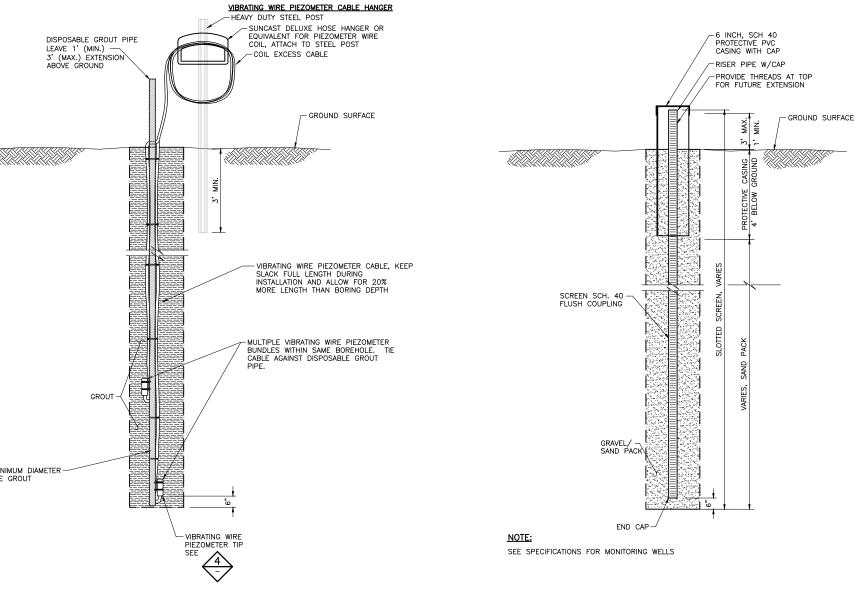
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277 BARR

HRF-021









ISSUE STATUS

VERSION

DATE

5/19/15

ISSUED

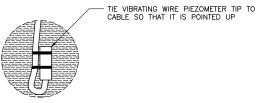
FOR PERMITTING

FOR CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.

DETAIL: TYPICAL (VW) VIBRATING WIRE PIEZOMETER INSTALLATION

DETAIL: TYPICAL (MW) FULLY SCREENED PIEZOMETER INSTALLATION



PLANT DRAWING NUMBER:							
HYDROMETALLURGICAL RESIDUE FACILTY							
GEOTECHNICAL							

INSTRUMENTATION DETAILS POLY MET MINING, INC.

HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS SPECIFICATION, OR REPORT WAS UPERVISION AND THAT I AM A DULY ICENSED PROFESSIONAL ENGINEER INDER THE LAWS OF THE STATE OF JUNISTRATE. DRAWN: CAD CHECKED: TJR PRINTED NAME <u>THOMAS J. RADUE</u> SIGNATURE *Thomas J. Radue* BARR PROJECT NO.: 23/69-0029 DATE 5/19/15 LICENSE# 20951

AS SHOWN

POLYMET **BARR**

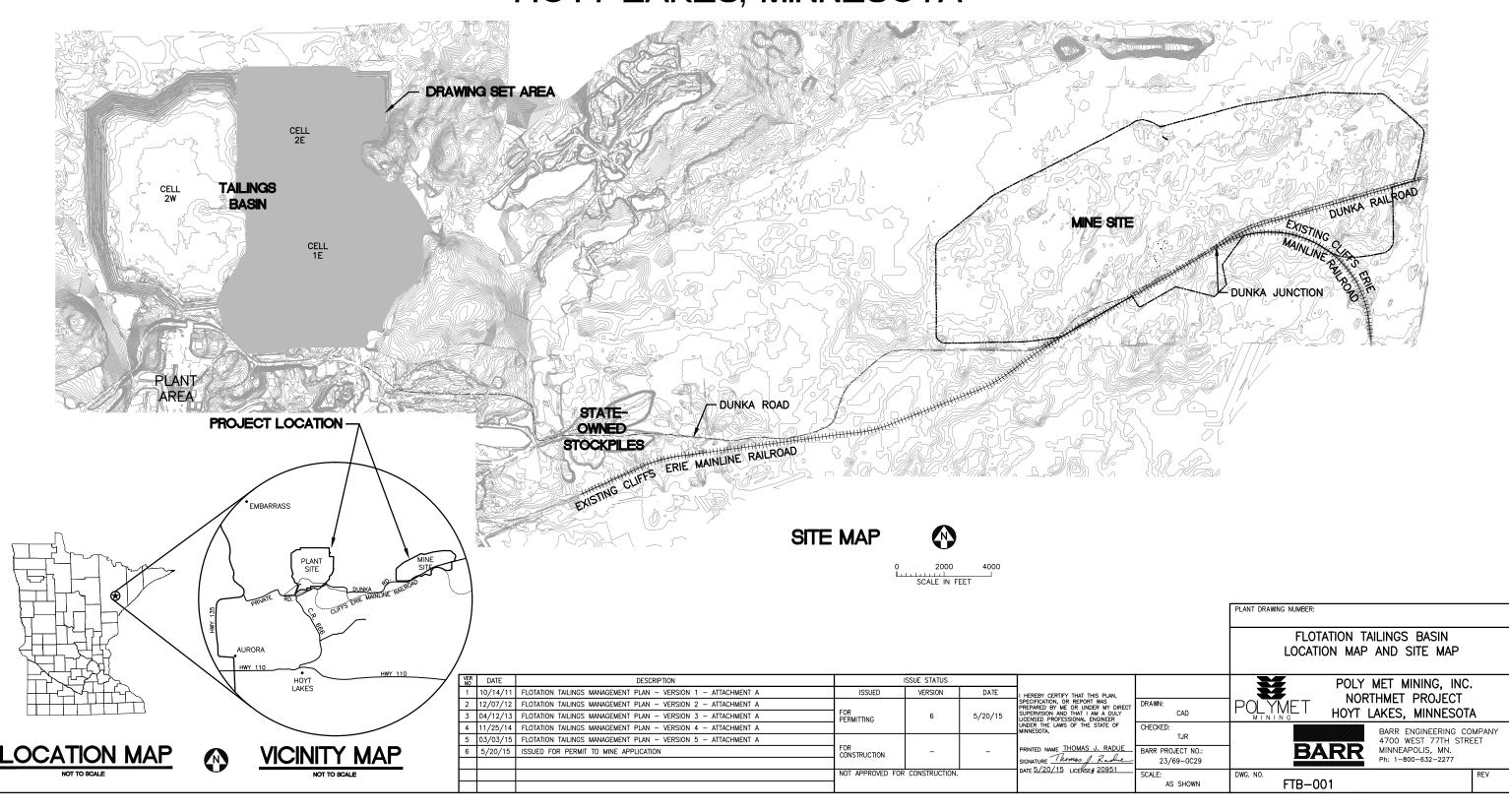
HRF-024

NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

Flotation Tailings Basin

POLY MET MINING, INC. NORTHMET PROJECT PERMIT SUPPORT DRAWINGS FLOTATION TAILINGS BASIN HOYT LAKES, MINNESOTA



GENERAL LEGEND

—1000 — EXISTING CONTOUR — MAJOR EXISTING CONTOUR - MINOR PROPOSED CONTOUR - MINOR EXISTING POWER POLE ----- EXISTING RAILROAD EXISTING ROAD ---- EXISTING TRAIL ====== EXISTING UNIMPROVED TRAIL EXISTING STRUCTURES $\sim\sim$ TREE LINE <u>علد</u> WETLAND BOUNDARY EXISTING CULVERT EXISTING PIPELINE -0E---OVERHEAD ELECTRIC DISCHARGE POINT DEWATERING OUTLET POINT RETURN PUMP PAD DEWATERING PUMP SURFACE DRAINAGE DRAINAGE COLLECTION STRUCTURE PROPOSED DAMS - DW ----- PROPOSED DEWATERING PIPE D —— PROPOSED DISCHARGE PIPELINE PROPOSED RETURN PIPELINE PROPOSED CULVERT (NON-MINE DRAINAGE) PROPOSED SEEPAGE COLLECTION DRAIN **-<<----**PROPOSED STORMWATER DRAIN 0 PROPOSED MANHOLE ---- PROPOSED WICK DRAIN LATERAL PIPE PROPOSED RIP RAP FILL SLOPE CUT SLOPE

ABBREVIATIONS

APPROX. - APPROXIMATE CDSM - CEMENT DEEP SOIL MIX CMP - CORRUGATED METAL PIPE CPEP - CORRUGATED POLYETHYLENE PIPE CY - CUBIC YARD

DR DIMENSION RATIO DWG DRAWING EL. ELEVATION F DIAMETER

FTB - FLOTATION TAILINGS BASIN GCL - GEOSYNTHETIC CLAY LINER HDPE - HIGH DENSITY POLYETHYLENE

HRF - HYDROMETALLURGICAL RESIDUE FACILITY

LDPE - LOW DENSITY POLYETHYLENE

LF - LINER FEET

LTVSMC - LTV STEEL MINING COMPANY

MCY - MILLION CUBIC YARDS one thousandth of an inch mil

MIN MINIMUM MSL - MEAN SEA LEVEL

NTS - NOT TO SCALE SCH - SCHEDULE

DR - DIMENSION RATIO TYP. TYPICAL

SHEET INDEX

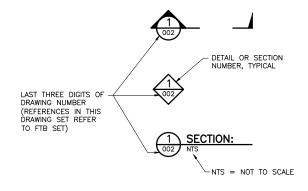
SHEET NO. TITLE

GENERAL DRAWINGS

GENERAL DRAWINGS

FTB-001 LOCATION MAP AND SITE MAP
FTB-002 LEGEND AND SHET INDEX
FTB-003 EXISTING CONDITIONS
FTB-004 LAYOUT MINE YEAR 20
FTB-005 LAYOUT MINE YEAR 1
FTB-006 LAYOUT MINE YEAR 1
FTB-006 LAYOUT MINE YEAR 7
FTB-008 NORTH DAM - MINE YEAR 7
FTB-009 NORTH DAM - TYPICAL CROSS SECTION
FTB-010 NORTH DAM - TYPICAL CROSS SECTION
FTB-011 EAST AND WEST DAMS - MINE YEAR 20 LAYOUT
FTB-015 EAST AND WEST DAMS - TYPICAL CROSS SECTIONS AND DRAINAGE SWALE
FTB-013 SOUTH DAM - MINE YEAR 20 LAYOUT
FTB-016 EAST AND WEST DAMS - TYPICAL CROSS SECTION
FTB-017 SOUTH DAM - MINE YEAR 20 LAYOUT
FTB-018 SOUTH DAM - TYPICAL CROSS SECTION
FTB-019 SOUTH DAM - TYPICAL CROSS SECTION
FTB-019 SOUTH DAM - TYPICAL CROSS SECTION
FTB-019 EMERGENCY OVERFLOW CHANNEL - LAYOUT
FTB-019 EMERGENCY OVERFLOW CHANNEL - SECTIONS
FTB-019 EMERGENCY OVERFLOW CHANNEL - SECTIONS
FTB-019 PIPING LAYOUT CELL 1/2E FTB-020 PIPING LAYOUT CELL 1/2E FTB-021 DETAILS FTB-022 TRANSFER PUMP RAFT FTB-023 TAILINGS DISPOSAL DIFFUSER RAFT FTB-024 CLOSURE PLAN

DRAWING NUMBERING



NOTES

- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE, NAD83.
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.
- 4. EXISTING TOPOGRAPHIC INFORMATION WAS UPDATED FOR AREAS SOUTH EAST OF COAL ASH LANDFILL AND EAST OF OUTCROP BETWEEN CELLS 1E AND 2E USING CONTOURS FROM DATA COLLECTED IN 1999.
- 5. FLOATATION TAILINGS BASIN DESIGN WAS BASED ON CONTOURS FROM DATA COLLECTED IN 1999. PROPOSED DAM LAYOUTS MAY NOT EXACTLY MATCH THE EXISTING TOPOGRAPHY FROM 2010 LIDAR.

FLOTATION TAILINGS BASIN LEGEND AND SHEET INDEX POLY MET MINING, INC.

BARR

FTB-002

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

MINNEAPOLIS, MN.

Ph: 1-800-632-2277

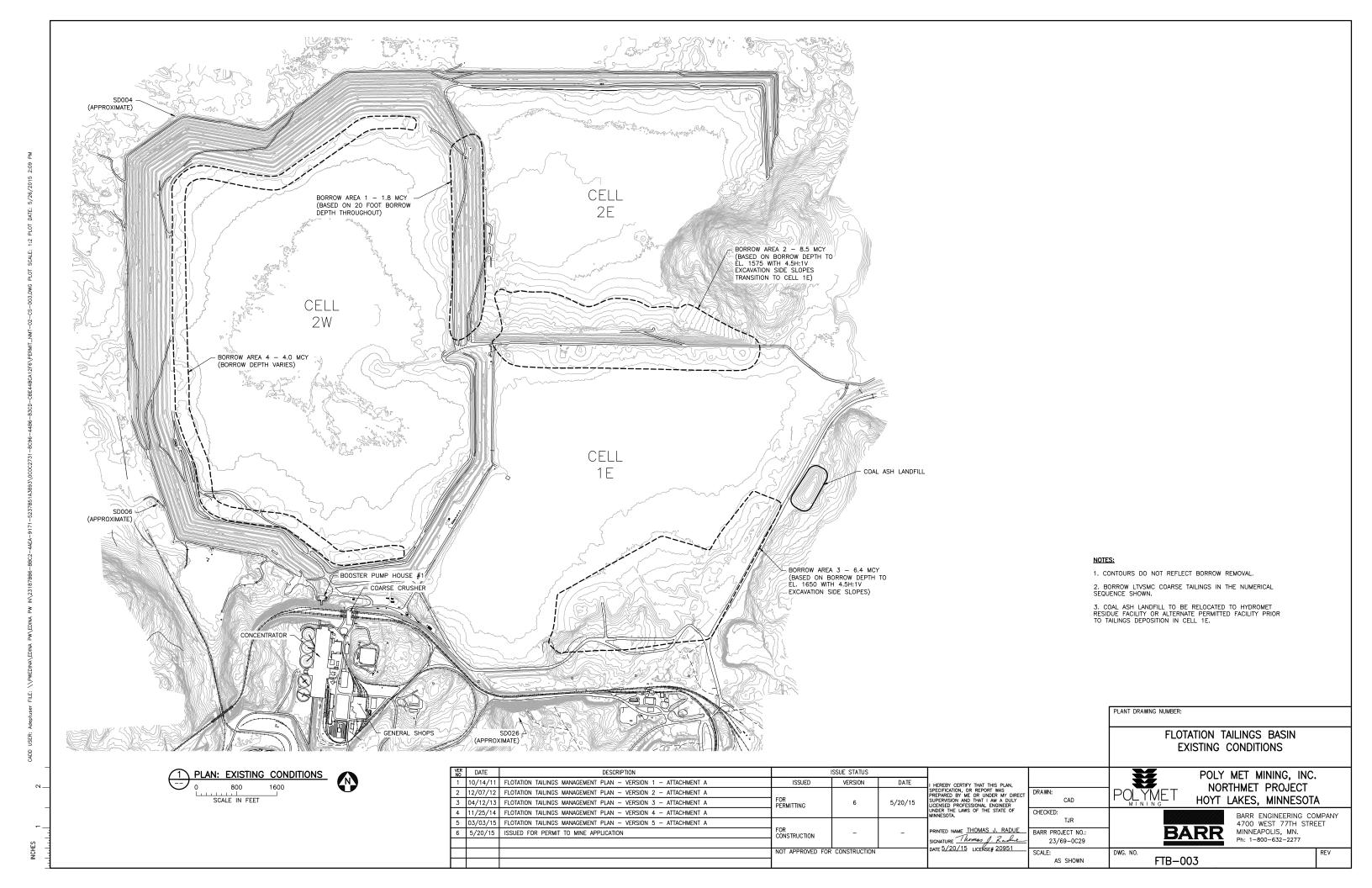
BARR ENGINEERING COMPANY

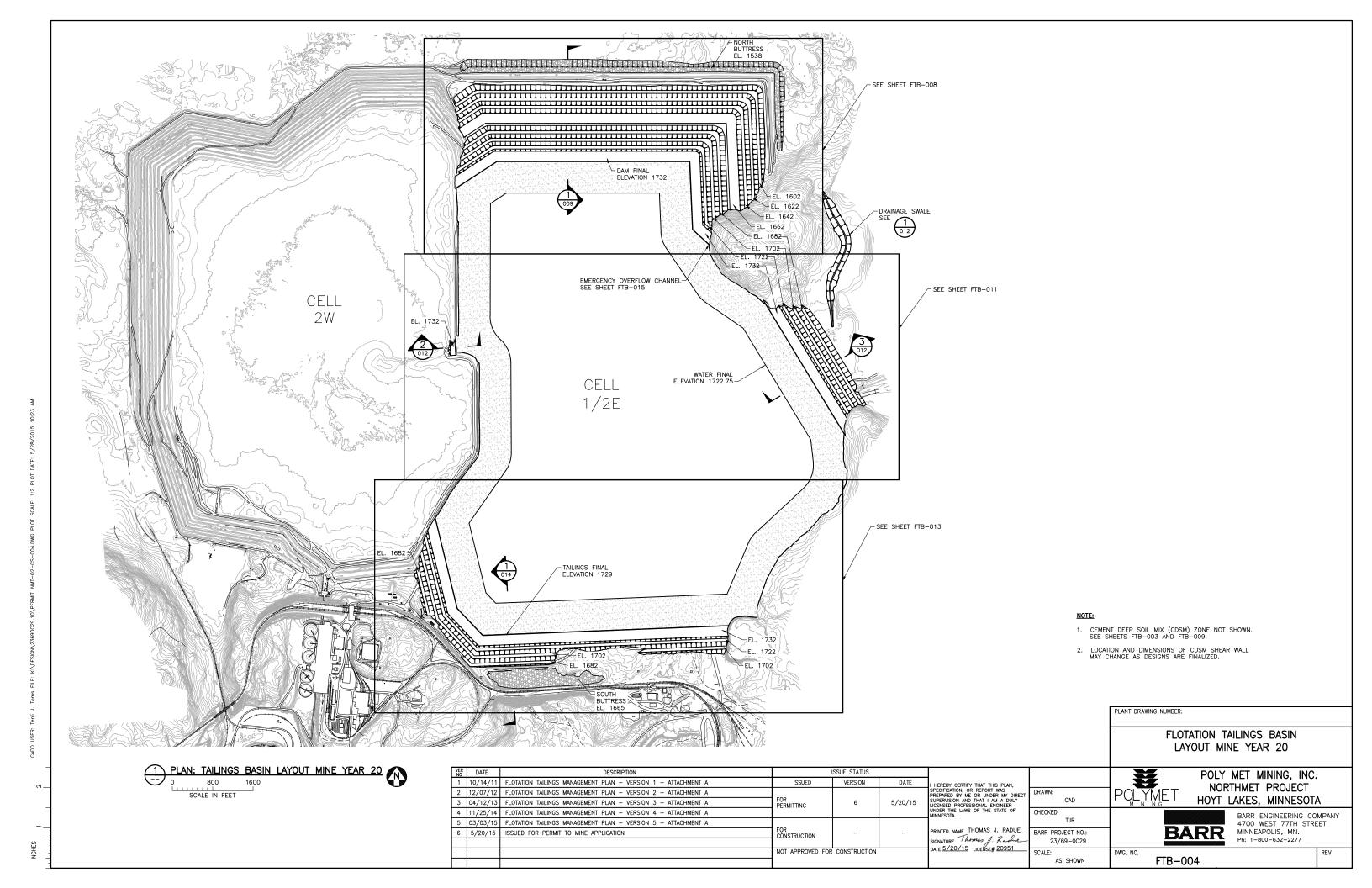
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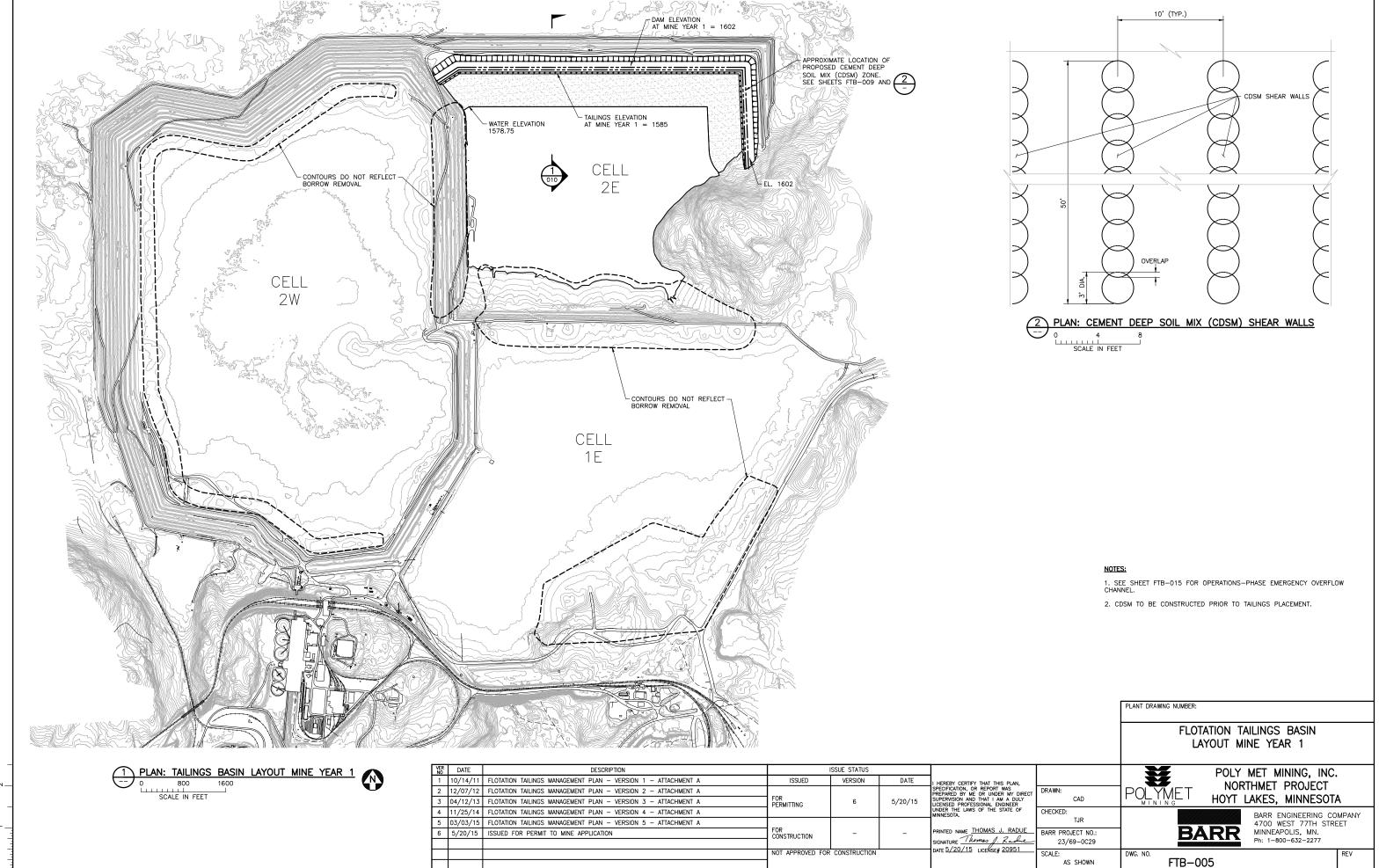
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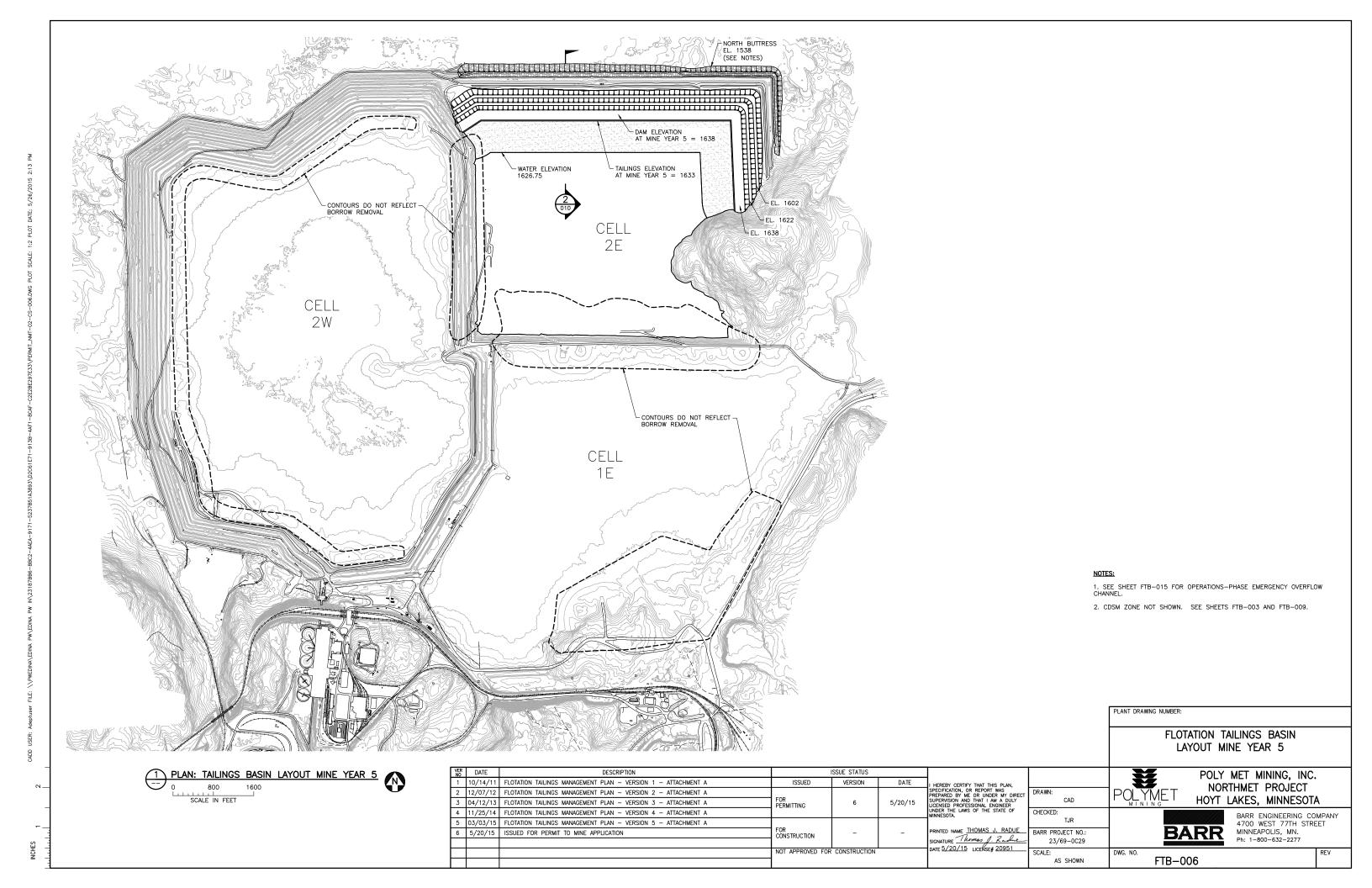
POLYMET

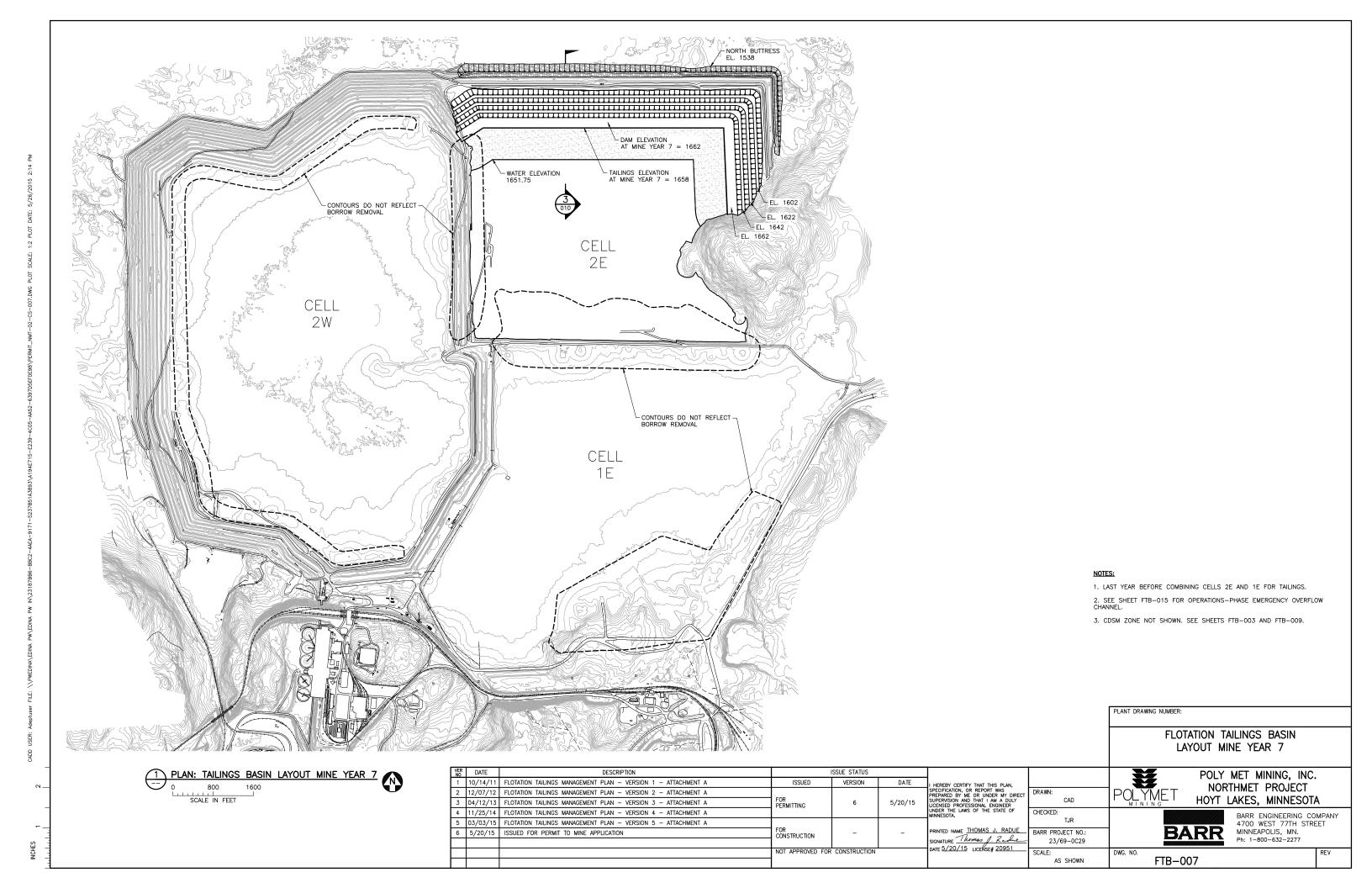
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2	12/07/12	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:
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6	5/20/15	ISSUED FOR PERMIT TO MINE APPLICATION	FOR CONSTRUCTION	-		PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:
						SIGNATURE Thomas J. Radie	23/69-0C29
			NOT APPROVED FOR CONSTRUCTION		DATE 5/20/15 LICENSE# 20951	SCALE:	
			1				AS SHOWN

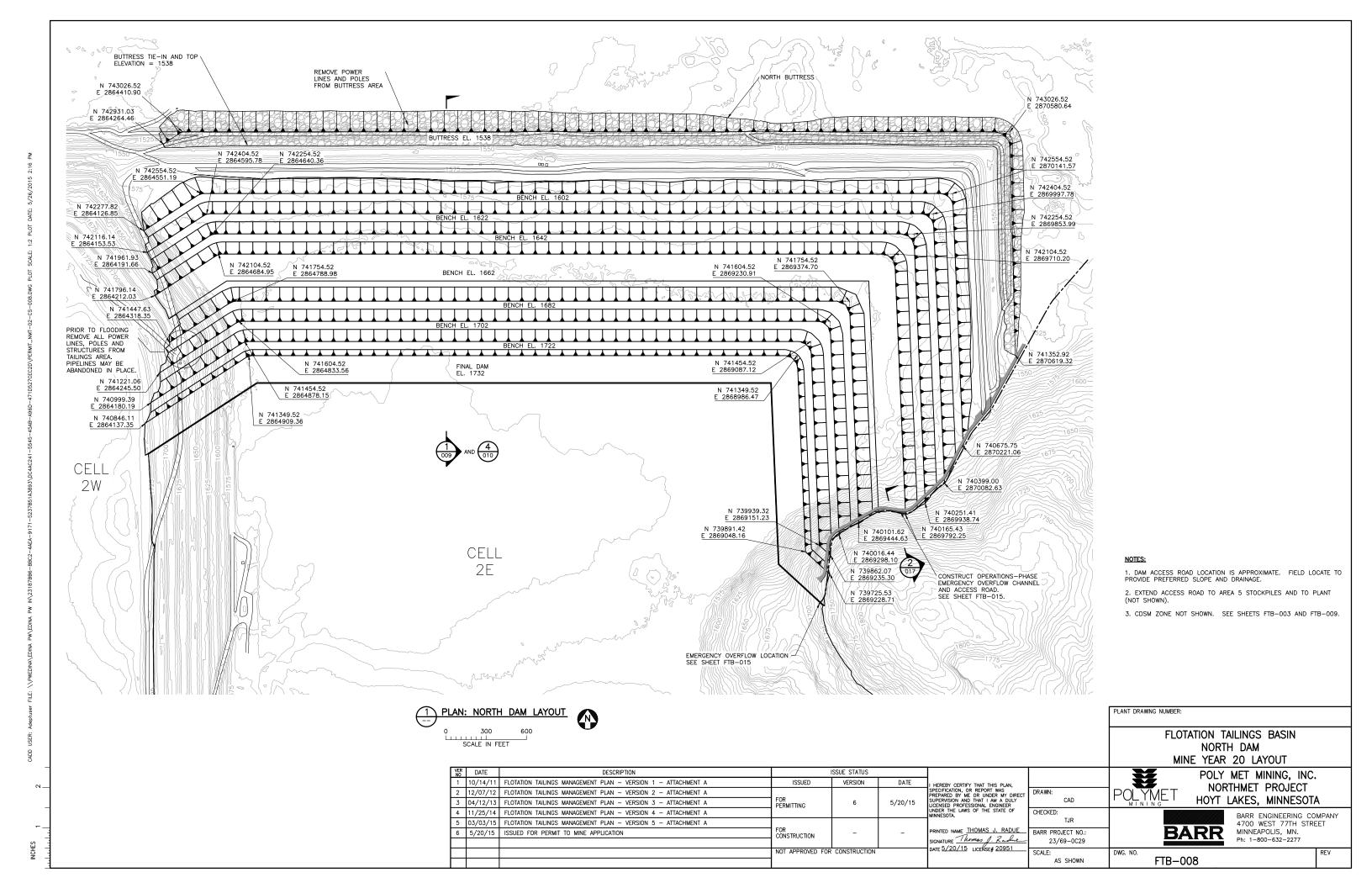


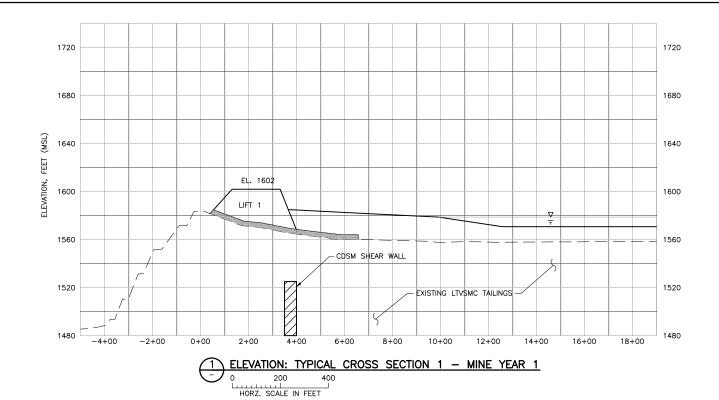


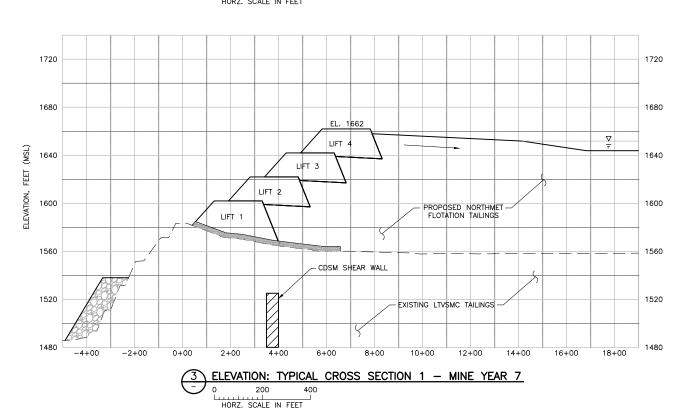


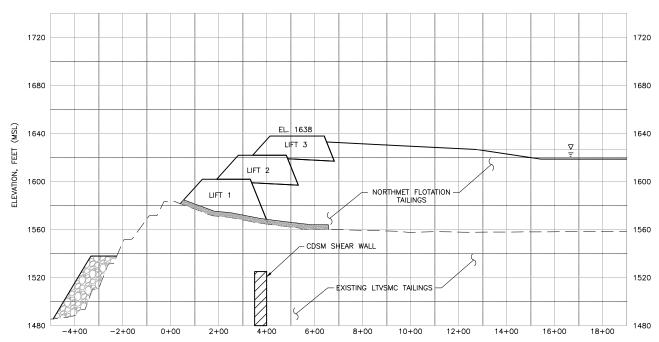


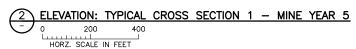


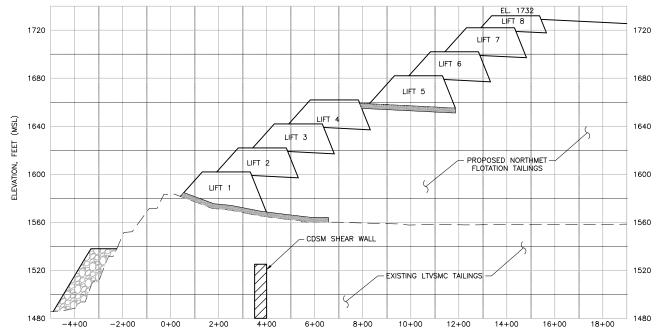












ELEVATION: TYPICAL CROSS SECTION 1 - MINE YEAR 20 HORZ. SCALE IN FEET

NOTE:

1. DAM AND BUTTRESS DIMENSIONS MAY CHANGE WITH EVALUATION OF FUTURE DAM STABILITY PERFORMANCE DATA.

2. PLACE BENTONITE AMENDED SOIL COVER ON OUTSIDE FACE OF NEW DAMS.

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				CONCINCONON			SIGNATURE Thomas J. Radie	23/69-0029
ſ				NOT APPROVED FOR CONSTRUCT			DATE 5/20/15 LICENSE# 20951	SCALE:
ſ				1				AS SHOWN

FLOTATION TAILINGS BASIN NORTH DAM STAGED CONSTRUCTION

POLYMET

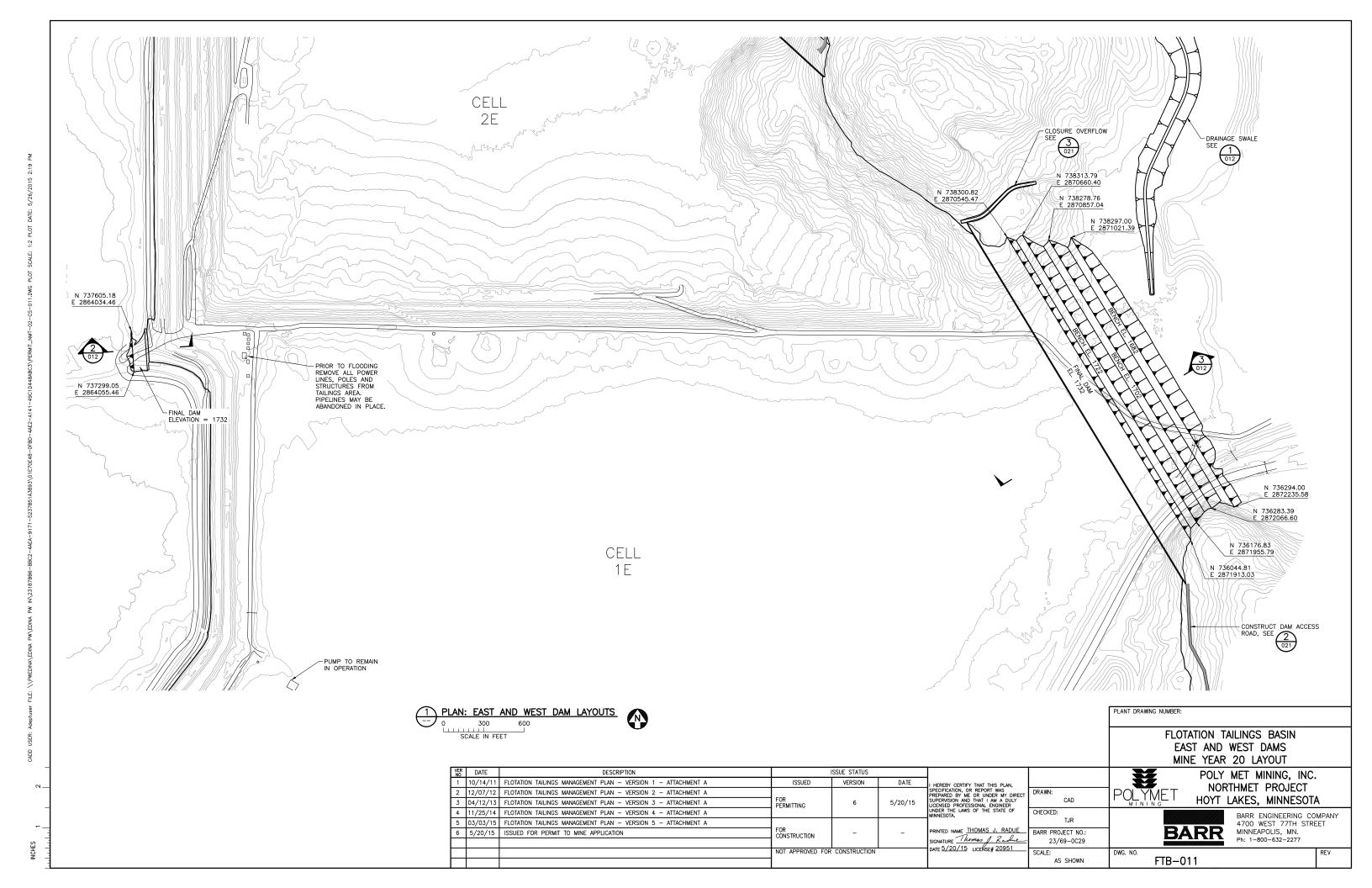
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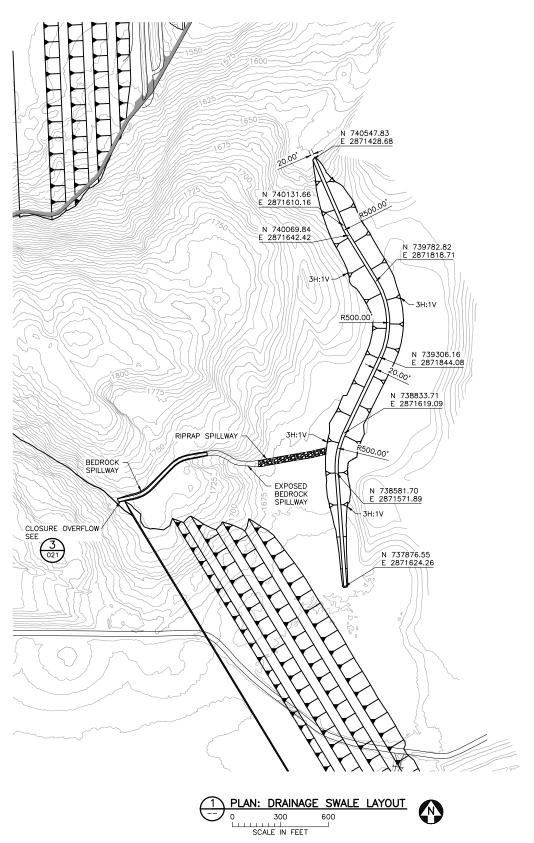
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

BARR

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

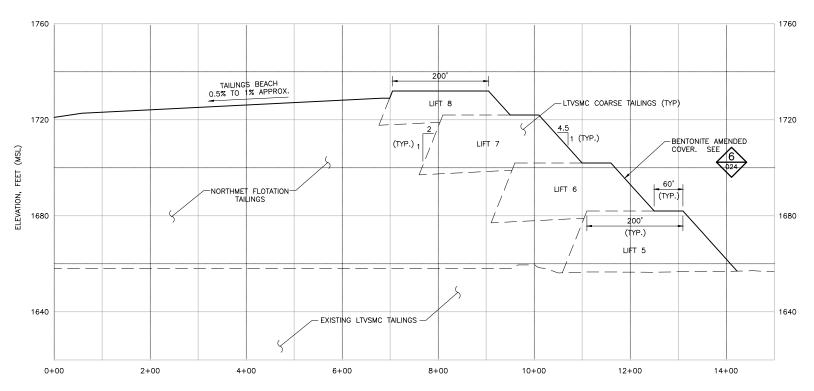
FTB-010





1760 1760 LTVSMC COARSE TAILINGS 1720 1720 `— EXISTING LTVSMC T∳ILINGS -1680 1680 4+00 0+00 2+00

HORZ. SCALE IN FEET



100 200

HORZ. SCALE IN FEET

1.CLOSURE OVERFLOW IS FOR EMERGENCY OVERFLOW ONLY UNTIL POND WATER QUALITY MEETS DISCHARGE WATER QUALITY REQUIREMENTS.

2. DAM DIMENSIONS MAY CHANGE WITH EVALUATION OF FUTURE DAM STABILITY PERFORMANCE DATA.

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FLOTATION TAILINGS BASIN EAST AND WEST DAMS TYPICAL CROSS SECTIONS AND DRAINAGE SWALE

POLYMET

PLANT DRAWING NUMBER:

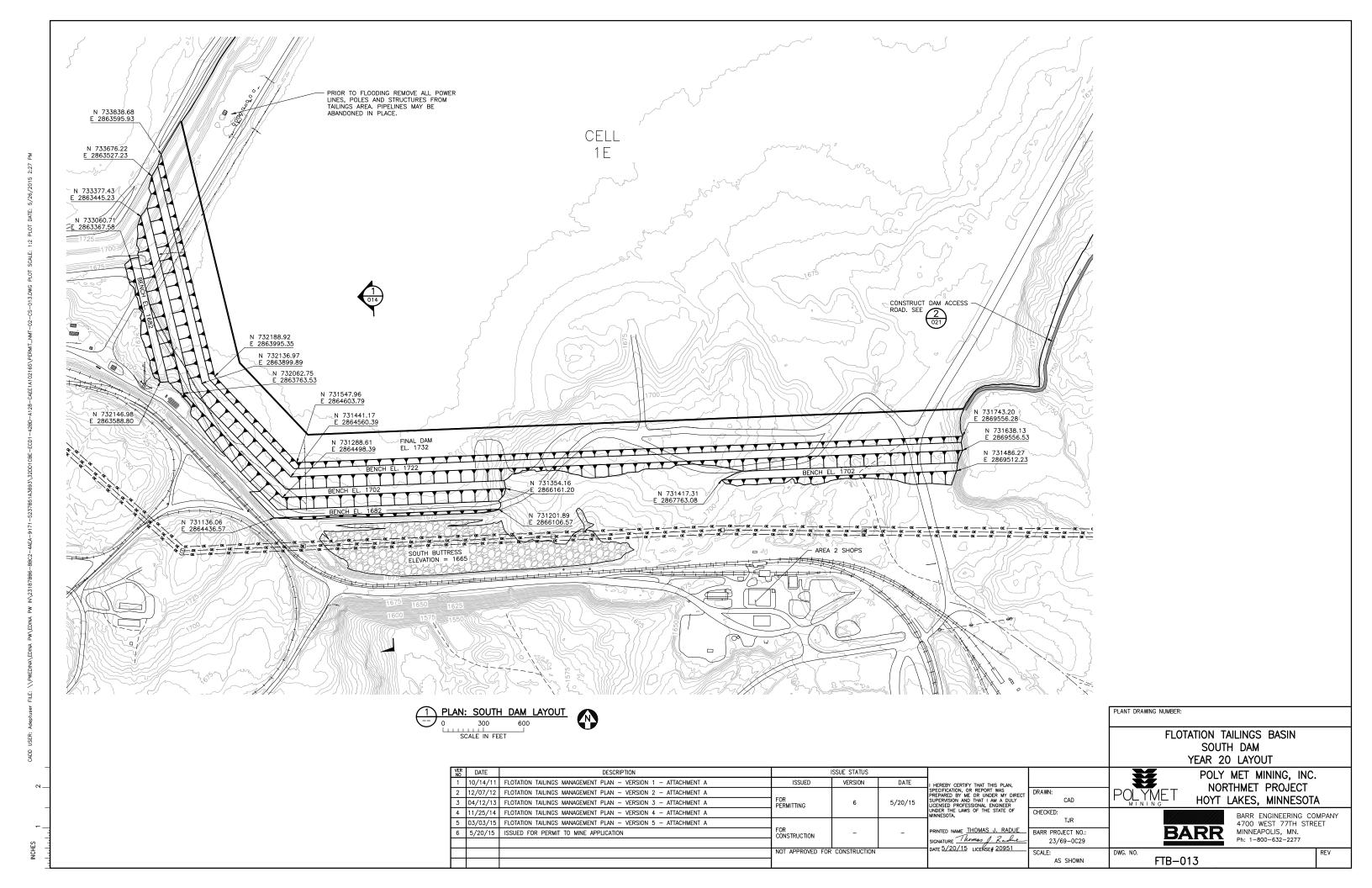
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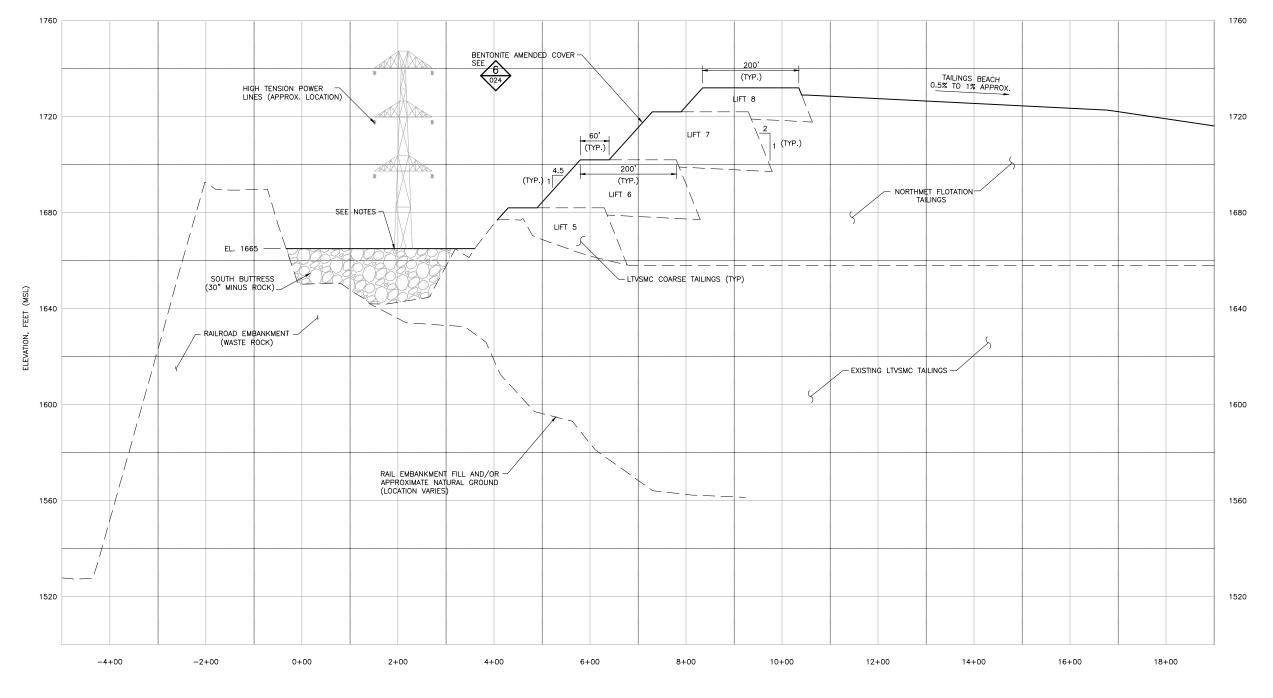
BARR

FTB-012

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

Ph: 1-800-632-2277





HORZ. SCALE IN FEET

1. DAM DIMENSIONS MAY CHANGE WITH EVALUATION OF FUTURE PERFORMANCE DATA.

2. HIGH TENSION POWER LINES SHOWN FOR REFERENCE. TOWER FOUNDATIONS ARE LOCATED OUTSIDE OF THE AREA COVERED BY THE BUTTRESS.

FLOTATION TAILINGS BASIN
SOUTH DAM
TYPICAL CROSS SECTIONS
POLY MET MINING, INC.
POLYMET NORTHMET PROJECT
HOYT LAKES, MINNESOTA

BARR

FTB-014

Ph: 1-800-632-2277

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

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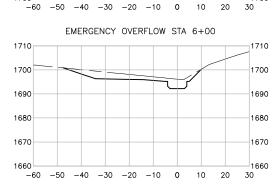
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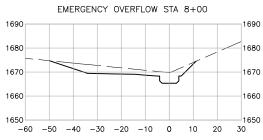
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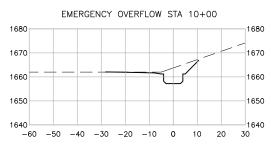
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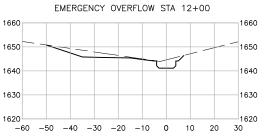
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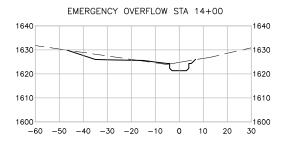
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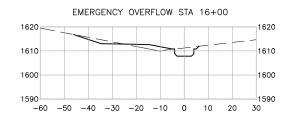


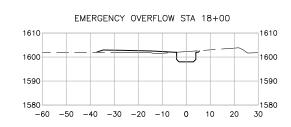


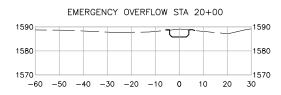


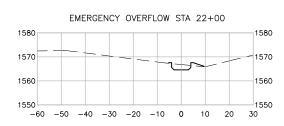


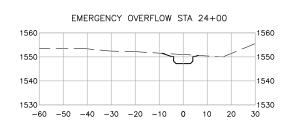


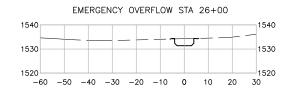


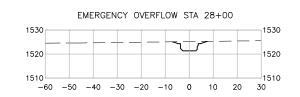


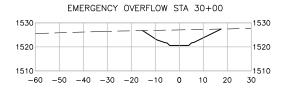


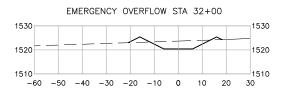


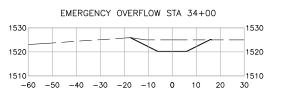


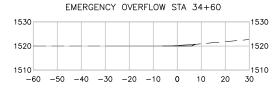












\bigcirc	SECTIONS	: EME	RGENCY	OVERFLOW	CHANNEL
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	SCALE	IN FEET			

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VER NO	DATE	DESCRIPTION		ISSUE STATUS			
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			Contoniconon			SIGNATURE Thomas J. Radie	23/69-0029
			NOT APPROVED FOR	CONSTRUCTION		DATE 5/20/15 LICENSE# 20951	SCALE:
			7				AS SHOWN

PLANT DRAWING NUMBER:

FLOTATION TAILINGS BASIN **EMERGENCY OVERFLOW CHANNEL SECTIONS**

POLYMET

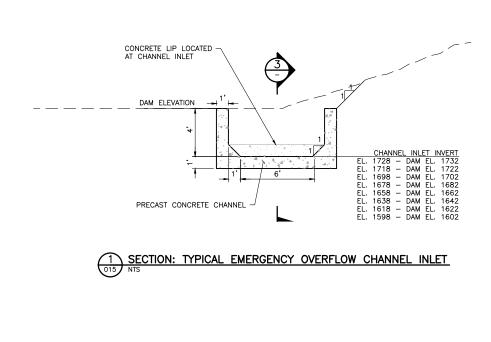
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

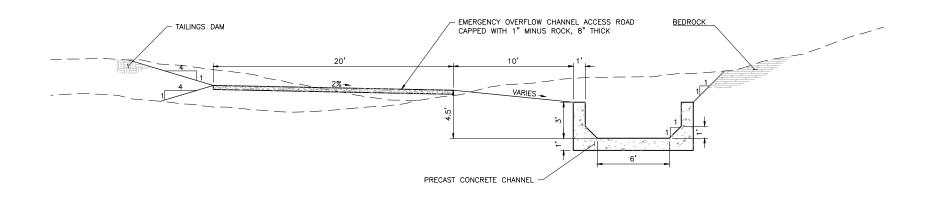


FTB-016

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

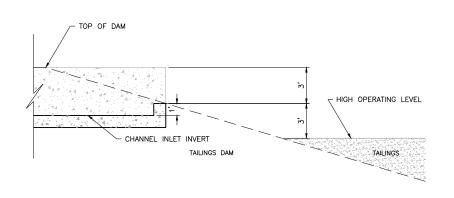


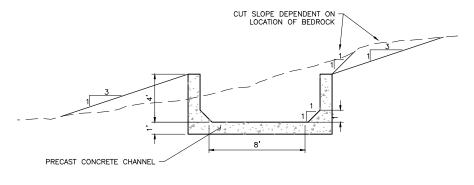


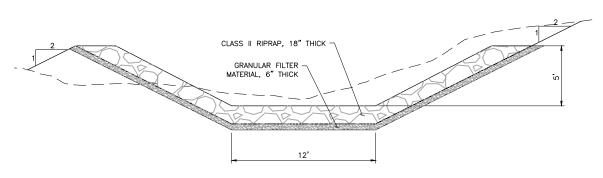


 $\underbrace{ ^2_{015} }_{\text{NTS}} \underbrace{ \text{SECTION: EMERGENCY OVERFLOW CHANNEL} }_{\text{NTS}}$

NOTE:
INCREASE EMERGENCY OVERFLOW CHANNEL DEPTH TO 4' WHEN CHANNEL SLOPE IS 0%







3 DETAIL: EMERGENCY OVERFLOW CHANNEL INLET

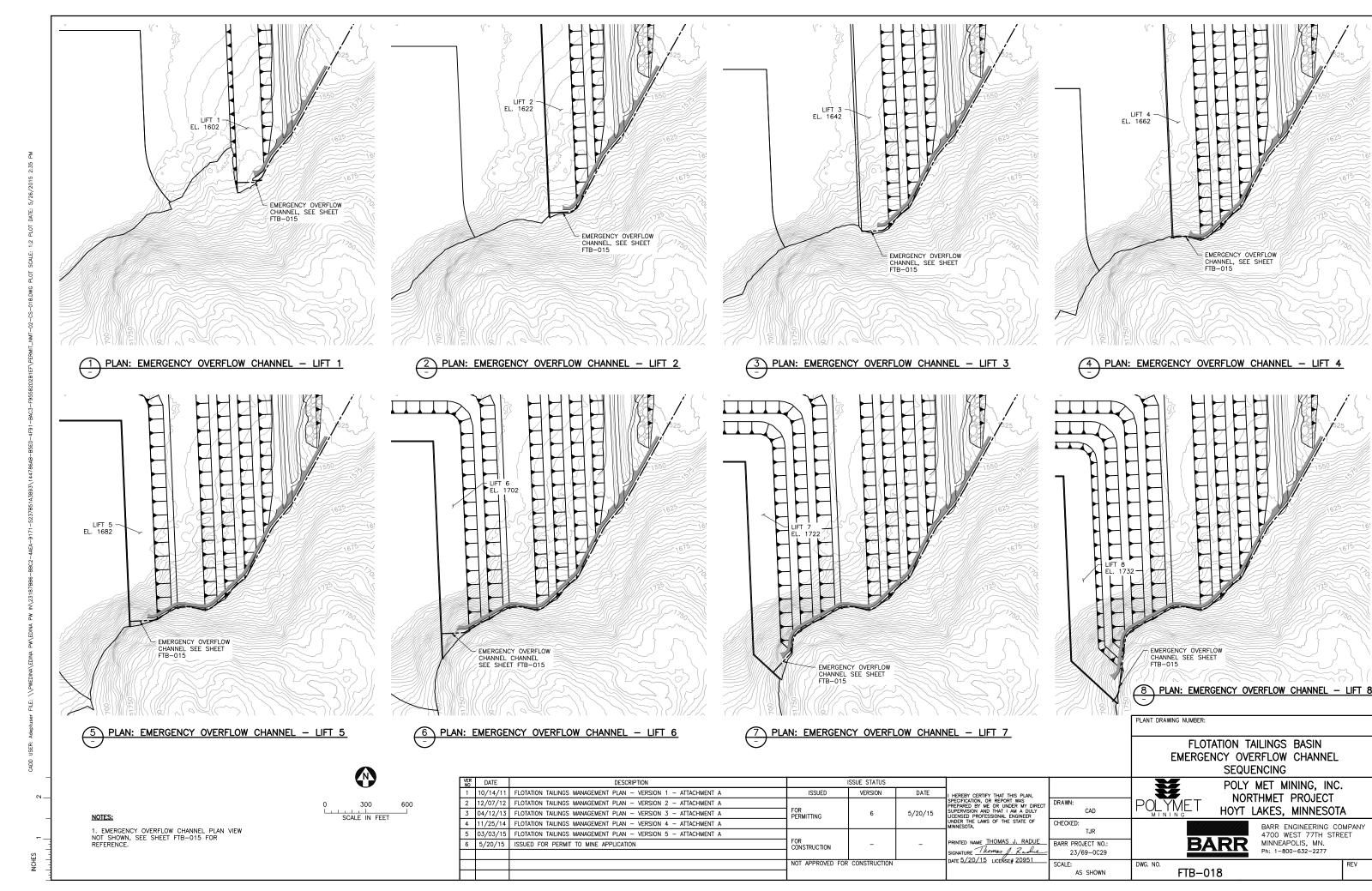
5 SECTION: RIPRAP OVERFLOW CHANNEL ENERGY DISSIPATOR - STA. 30+10 - 34+60

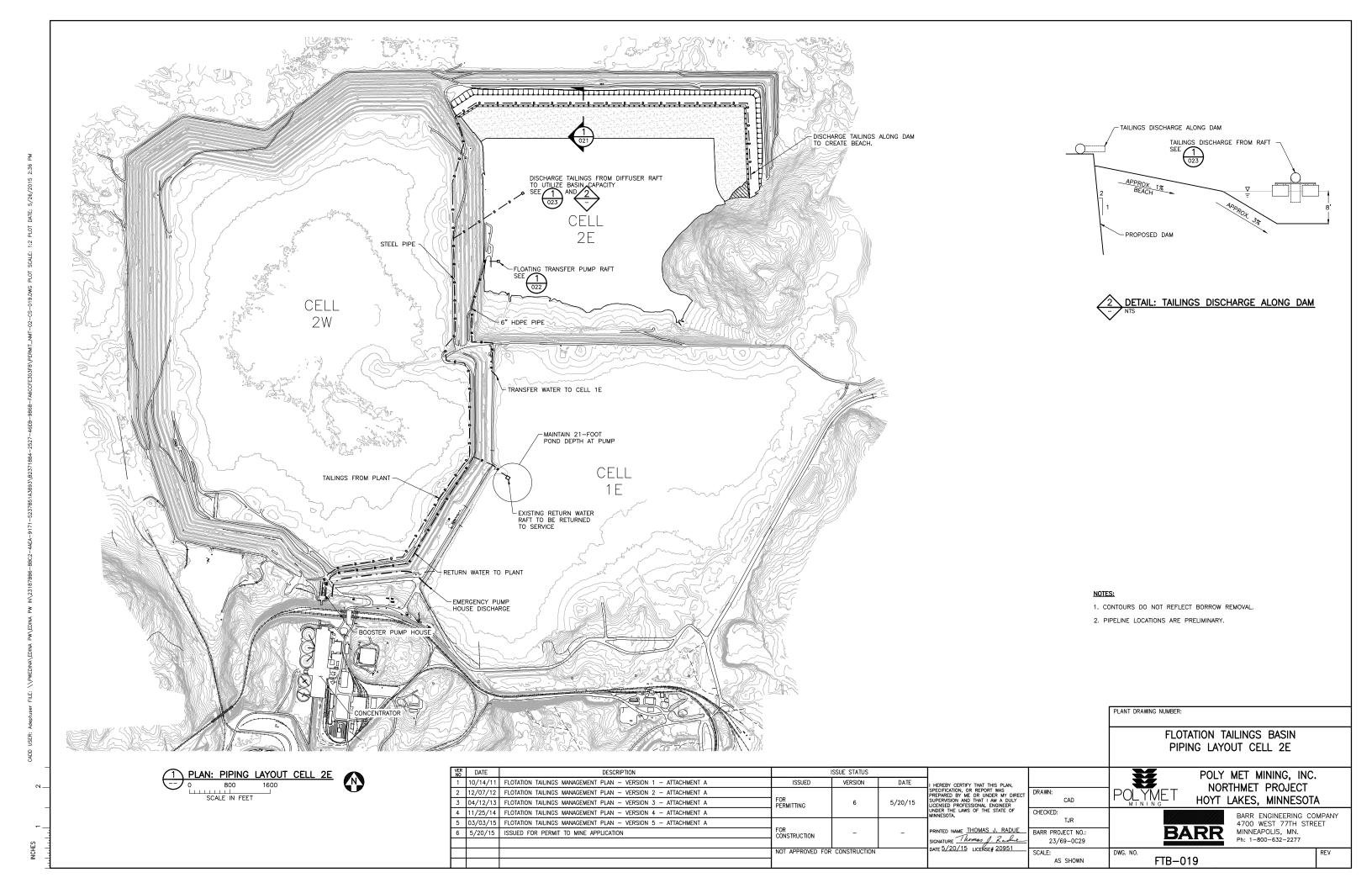
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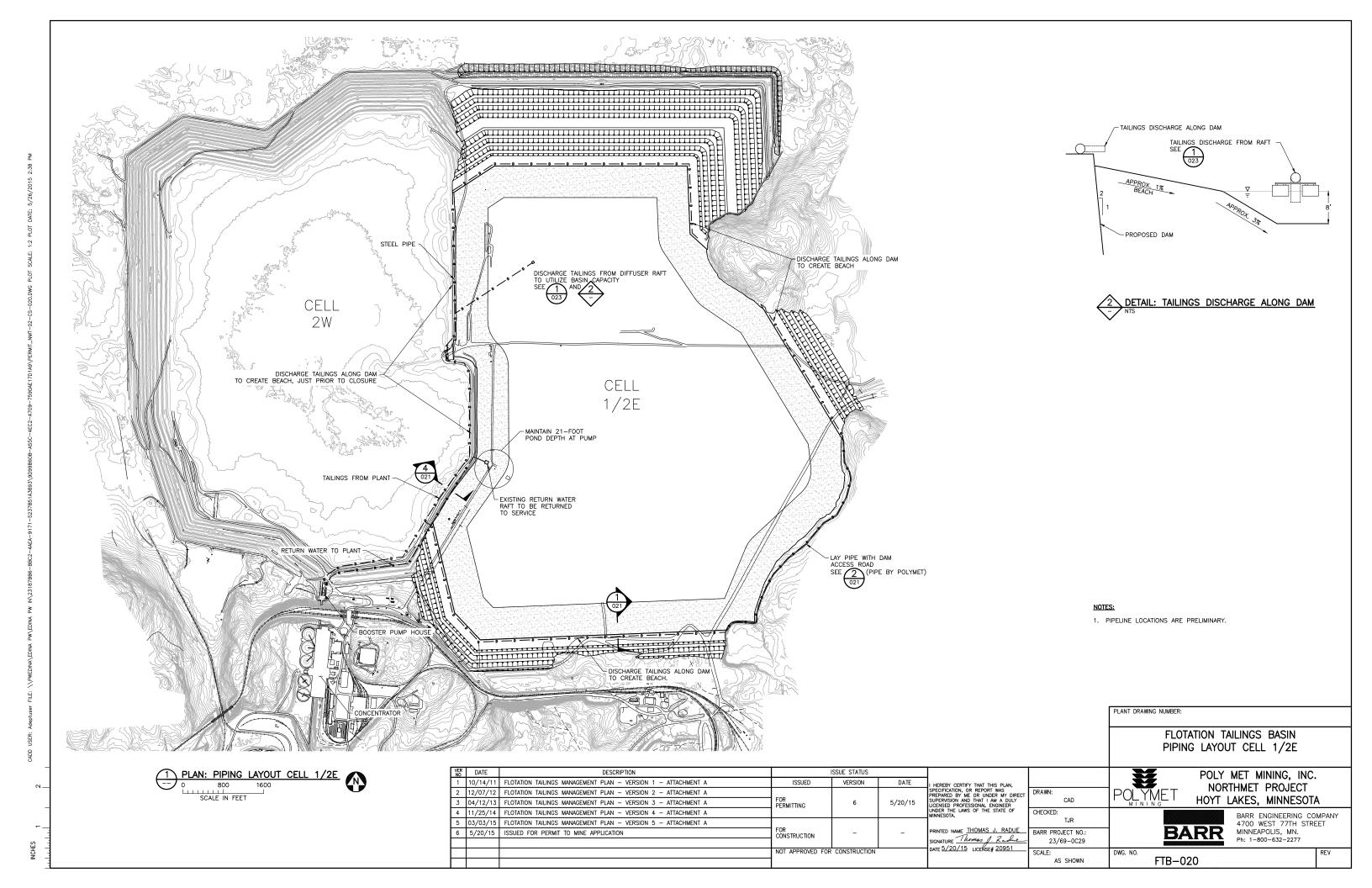
FLOTATION TAILINGS BASIN

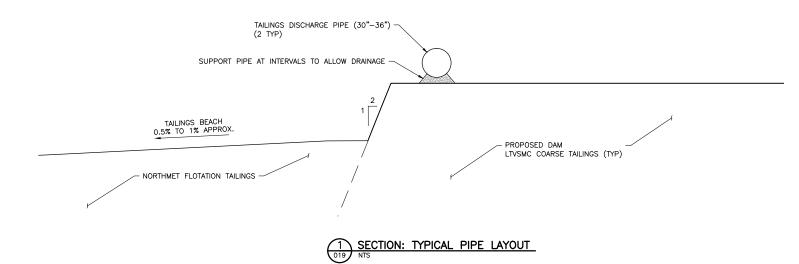
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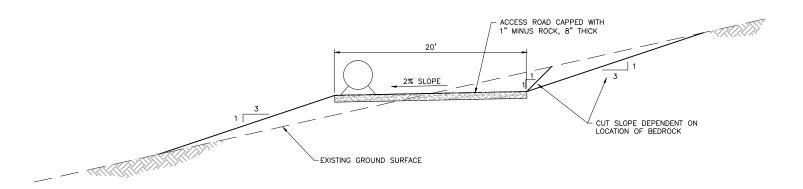
								EMERGE	NCY OVERFLOW CHANNEL DETAILS
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			- Contoniconon			SIGNATURE Thomas J. Radie	23/69-0029		Ph: 1-800-632-2277
			NOT APPROVED FO	R CONSTRUCTION	ı İ	DATE 5/20/15 LICENSE# 20951	SCALE:	DWG. NO.	REV
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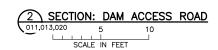


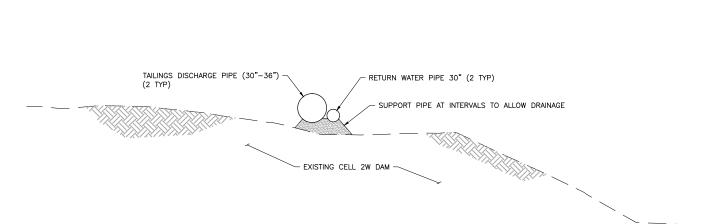












 $\underbrace{ \underbrace{ \underbrace{ \text{3} \atop \text{011}} }_{0} \underbrace{ \text{SECTION: CLOSURE EMERGENCY OVERFLOW} }_{5} }_{5}$

SCALE IN FEET

_BEDROCK

BEDROCK -

4 SECTION: TYPICAL RETURN PIPE LAYOUT

PLANT DRAWING NUMBER:

POLYMET

FLOTATION TAILINGS BASIN DETAILS

BARR

FTB-021

POLY MET MINING, INC.

NORTHMET PROJECT

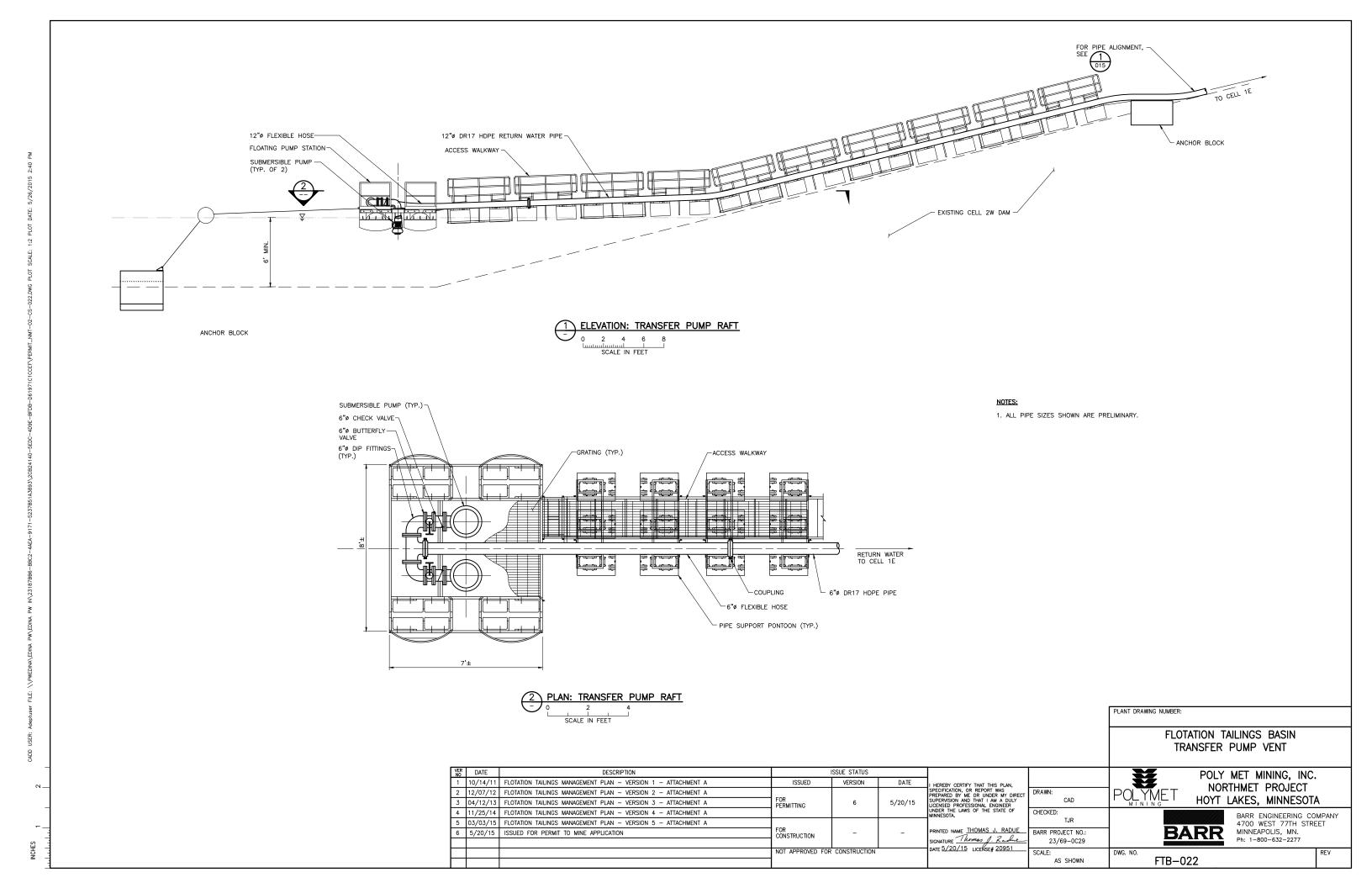
HOYT LAKES, MINNESOTA

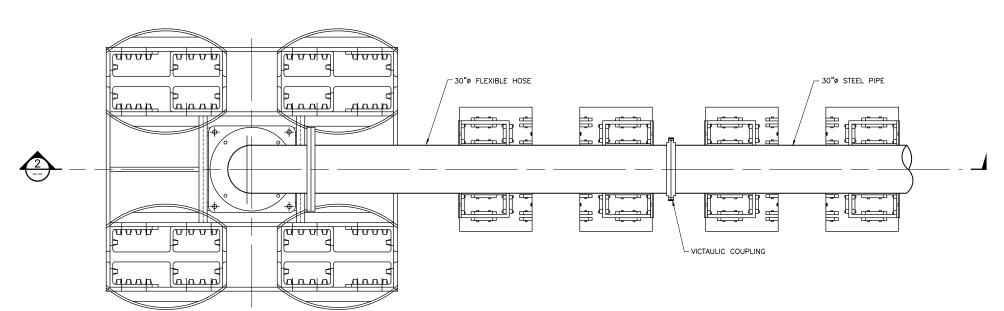
Ph: 1-800-632-2277

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

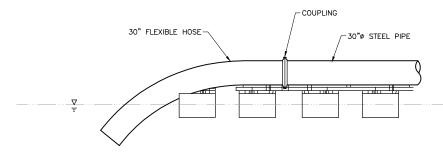
- 1. EMERGENCY OVERFLOW SIZING AND CONFIGURATION IS PRELIMINARY.
- 2. PIPELINE INFORMATION IS PRELIMINARY.
- 3. CONSTRUCT CLOSURE EMERGENCY OVERFLOW AT CLOSURE. OPERATIONS—PHASE EMERGENCY OVERFLOW TO BE MAINTAINED OR REMOVED AT OWNER'S DETERMINATION.
- 4. ALL PIPE SIZES SHOWN ARE PRELIMINARY.

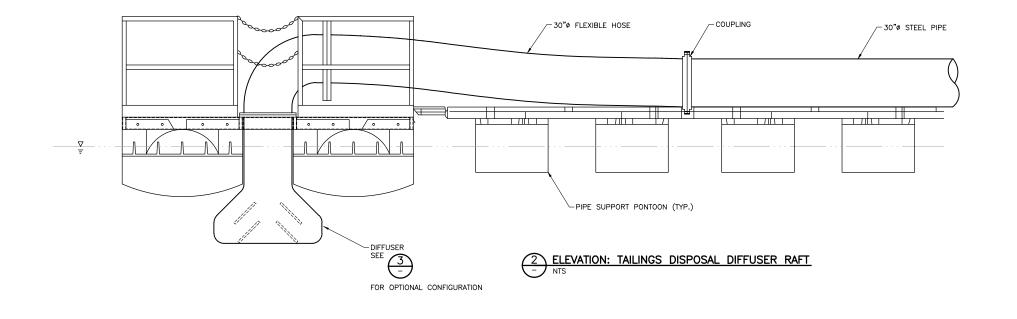
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2	12/07/12	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.	DRAWN:
3	04/12/13	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 3 - ATTACHMENT A	FOR PERMITTING	6	5/20/15		CAD
4	11/25/14	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 4 - ATTACHMENT A					CHECKED:
5	03/03/15	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 5 - ATTACHMENT A					TJR
6	5/20/15	ISSUED FOR PERMIT TO MINE APPLICATION	FOR CONSTRUCTION	_		PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:
			Contoniconon			SIGNATURE Thomas J. Radie	23/69-0C29
			NOT APPROVED FOR CONSTRUCTION			DATE 5/20/15 LICENSE# 20951	SCALE:
							AS SHOWN





1 PLAN: TAILINGS DISPOSAL DIFFUSER RAFT
NTS





3 ELEVATION: PIPE OPEN END OPTION
NTS

PLANT DRAWING NUMBER:

NOTES:

1. ALL PIPE SIZES SHOWN ARE PRELIMINARY.

FLOTATION TAILINGS BASIN

TAILINGS DISPOSAL DIFFUSER RAFT

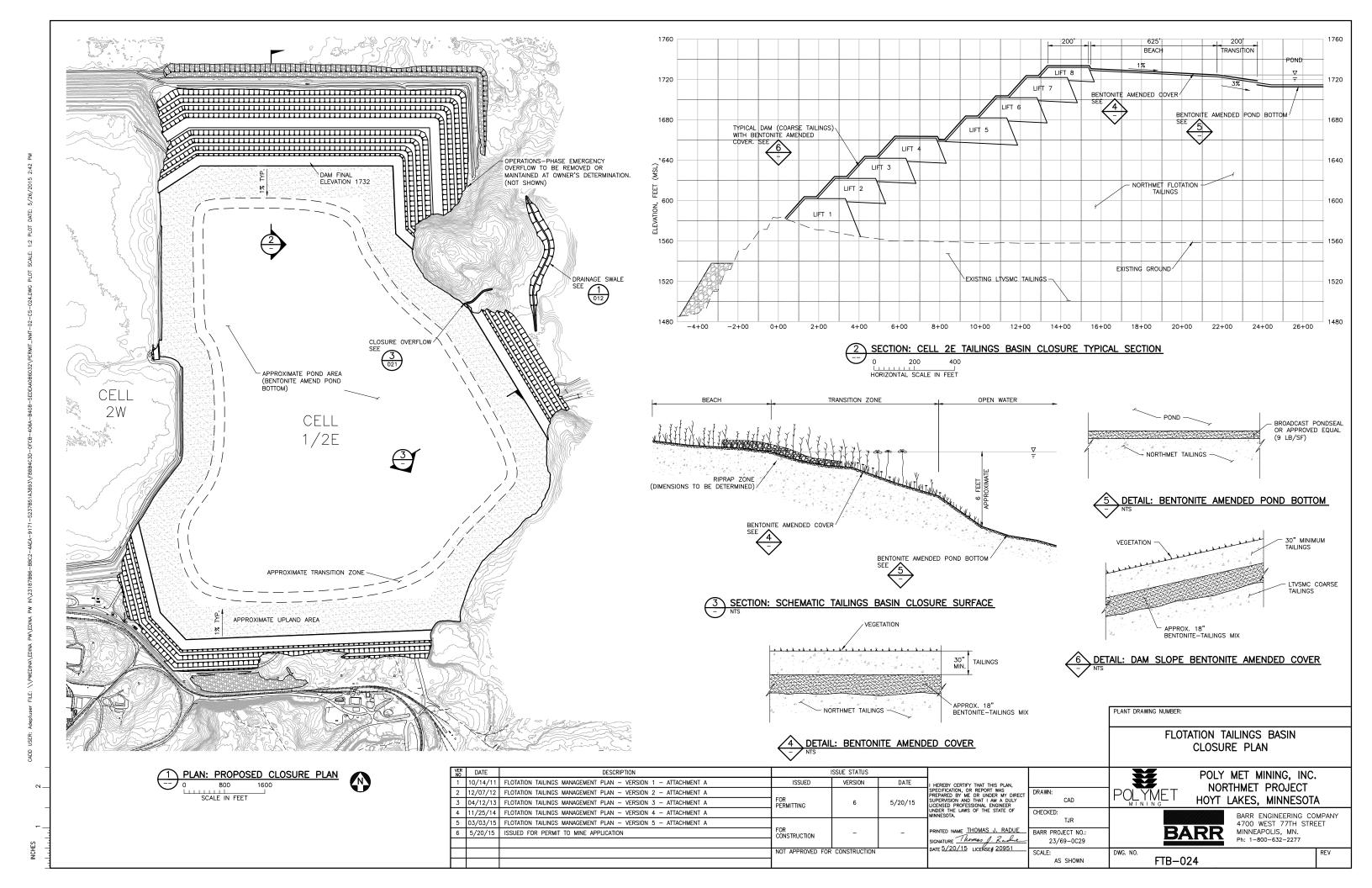
VER NO	DATE	DESCRIPTION	I	ISSUE STATUS				
1	10/14/11	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 1 - ATTACHMENT A	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.		
2	12/07/12	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 2 - ATTACHMENT A				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:	
3	04/12/13	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 3 - ATTACHMENT A	FOR PERMITTING		TING 6	5/20/15	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	CAD
4	11/25/14	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 4 - ATTACHMENT A				UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:	
5	03/03/15	FLOTATION TAILINGS MANAGEMENT PLAN - VERSION 5 - ATTACHMENT A					TJR	
6	5/20/15	ISSUED FOR PERMIT TO MINE APPLICATION	FOR CONSTRUCTION	-		PRINTED NAME THOMAS J. RADUE	BARR PROJECT NO.:	
						SIGNATURE Thomas J. Radie	23/69-0C29	
			NOT APPROVED FOR	CONSTRUCTION		DATE 5/20/15 LICENSE# 20951	SCALE:	
						l	AS SHOWN	

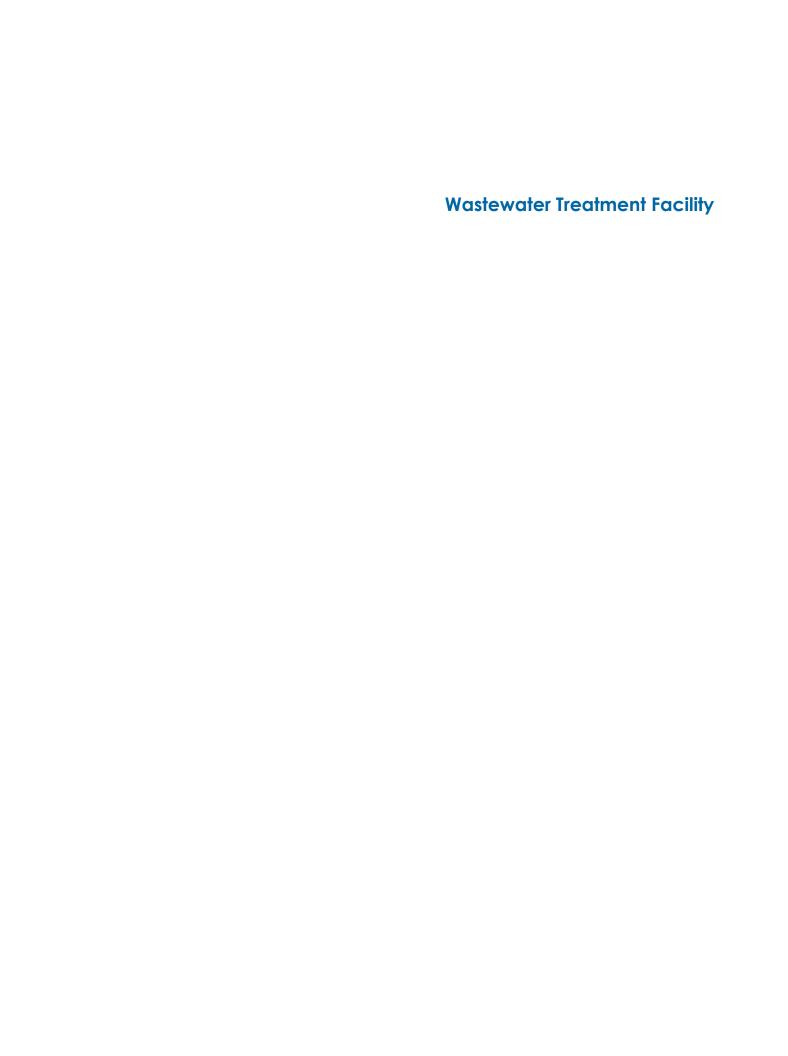
POLYMET MINING POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA

FTB-023

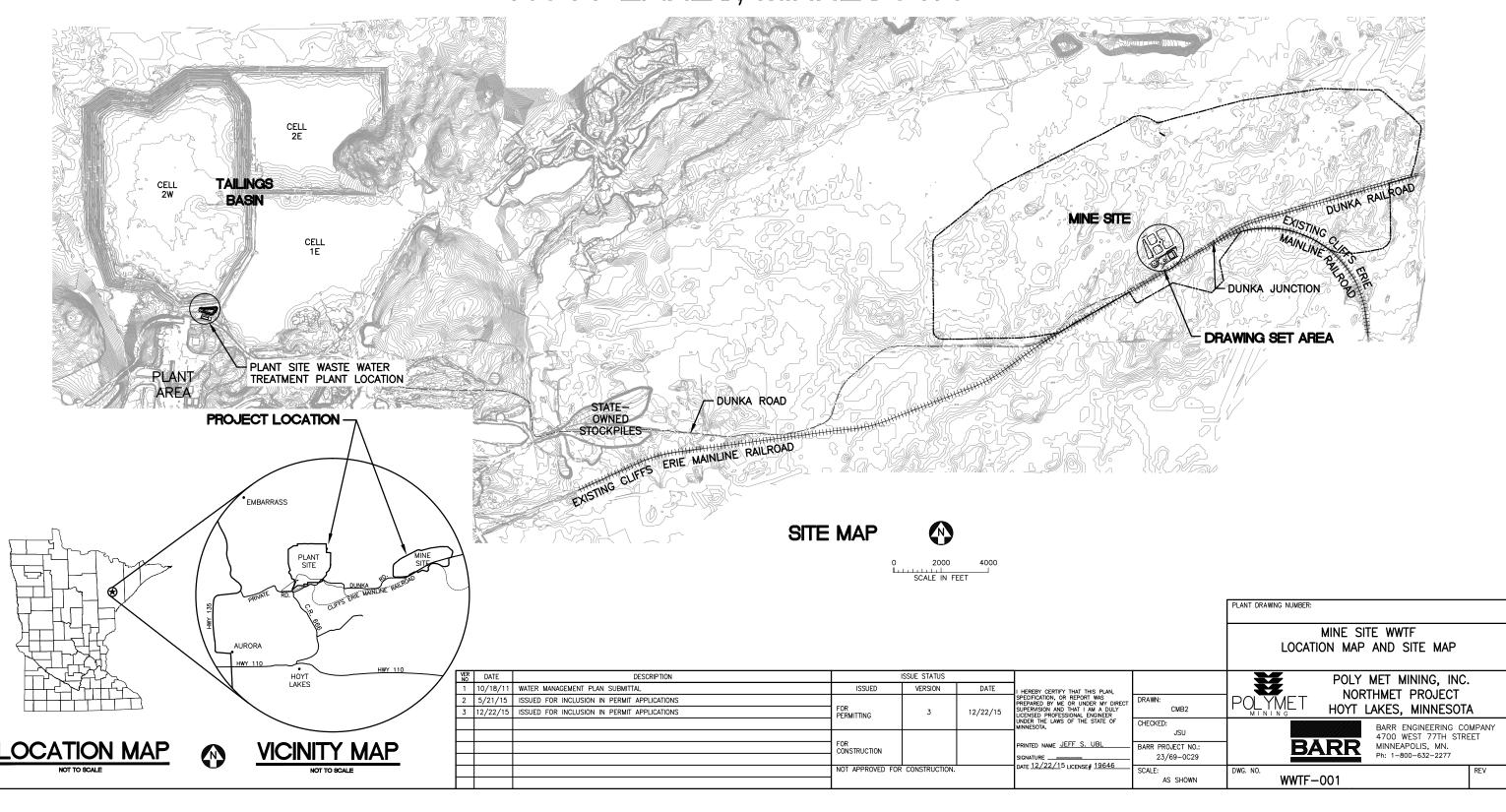
BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

BARR





POLY MET MINING, INC. NORTHMET PROJECT PERMIT APPLICATION SUPPORT DRAWINGS MINE SITE WASTE WATER TREATMENT FACILITY HOYT LAKES, MINNESOTA



DRAWING INDEX

TITLE DRAWING NO.

GENERAL DRAWINGS

TITLE SHEET

LOCATION MAP AND SITE MAP LEGEND, ABBREVIATIONS, AND DRAWING INDEX WWTF-001

CIVIL - SITEWORK

EXISTING SITE PLAN SITE GRADING PLAN AND CONSTRUCTION LIMITS YARD PIPING PLAN WWTF-004

WWTF-005

BASINS LINER PLAN
BASINS - INLET AND OUTLET SECTIONS
BASINS - SECTION AND DETAILS
YARD PIPING SECTIONS AND DETAILS WWTF-008

WWTF-009 WWTF-010 WWTF-011

CIVIL - UTILITIES

SPLITTER STRUCTURE — UPPER LEVEL PLAN SPLITTER STRUCTURE — LOWER LEVEL PLAN SPLITTER STRUCTURE — SECTION — MISCELLANEOUS

MECHANICAL

WWTF-015 MECHANICAL SYMBOLS AND LEGEND

MECHANICAL - FLOWSHEETS, P&ID'S, ETC.

WWTF-016 WWTF-017

HYDRAULIC PROFILE HYDRAULIC PROFILE - RESIDUALS WWTF-018

HYDRAULIC PROFILE — RESIDUALS
PROCESS FLOW DIAGRAM OVERVIEW
PROCESS FLOW DIAGRAM — EQUALIZATION BASINS
PROCESS FLOW DIAGRAM — CHEMICAL PRECIPITATION OVERVIEW
PROCESS FLOW DIAGRAM — HDS METALS REMOVAL
PROCESS FLOW DIAGRAM — SULFATE REMOVAL
PROCESS FLOW DIAGRAM — SULFATE REMOVAL
PROCESS FLOW DIAGRAM — RECARBONATION
PROCESS FLOW DIAGRAM — GREENSAND FILTERS AND PRIMARY MEMBRANES
PROCESS FLOW DIAGRAM — SECONDARY MEMBRANES
PROCESS FLOW DIAGRAM — SCONDARY MEMBRANES

WWTF-021 WWTF-022

WWTF-025

PROCESS FLOW DIAGRAM — SECONDARY MEMBRANES PROCESS FLOW DIAGRAM — SOLIDS HANDLING PROCESS FLOW DIAGRAM — LIME SYSTEM PROCESS FLOW DIAGRAM — CARBON DIOXIDE SYSTEM PROCESS FLOW DIAGRAM — CHEMICAL SYSTEMS PROCESS FLOW DIAGRAM — PLANT WATER SYSTEM

WWTF-029

MECHANICAL LAYOUTS

WWTF-031

OVERALL GENERAL ARRANGEMENT
GENERAL ARRANGEMENT — MEDIA FILTER AND PRIMARY MEMBRANE AREA
GENERAL ARRANGEMENT — SECONDARY MEMBRANE AREA
GENERAL ARRANGEMENT — CHEMICAL PRECIPITATION AREA
GENERAL ARRANGEMENT — SOLIDS HANDLING AREA
GENERAL ARRANGEMENT — CHEMICAL STORAGE AREA

WWTF-032 WWTF-033

GENERAL LEGEND

EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR **—1000 ——** PROPOSED CONTOUR - MAJOR PROPOSED CONTOUR - MINOR \otimes EXISTING POWER POLE (i) UNIDENTIFIED EXISTING RAILROAD EXISTING ROAD ---- EXISTING TRAIL ======= EXISTING UNIMPROVED TRAIL EXISTING STRUCTURES $\sim\sim$ TREE LINE <u> 1</u> WETLAND BOUNDARY EXISTING CULVERT ___P___ EXISTING PIPELINE

MnDOT CATEGORY 4 EROSION CONTROL BLANKET

INLET PROTECTION AND DITCH CHECKS

MnDOT TYPE 4 MULCH

PROPOSED CULVERT (NON-MINE DRAINAGE) 0 PROPOSED MANHOLE

PROPOSED SILT FENCE —*<*—*<*— PROPOSED PIPELINE

CONSTRUCTION LIMITS

PROPOSED STRUCTURES PROPOSED STRUCTURE EXPANSION

PROPOSED RIPRAP

PROPOSED ROAD SURFACE DRAINAGE TWP ALIGNMENT

PROPOSED RAIL ROAD

GENERAL ABBREVIATIONS

TWP - TREATED WATER PIPELINE

CPS - CENTRAL PUMPING STATION

WWTP - WASTE WATER TREATMENT PLANT

WWTF - WASTE WATER TREATMENT FACILITY

CATEGORY 1 STOCKPILE - CATEGORY 1 WASTE ROCK STOCKPILE

OSLA - OVERBURDEN STORAGE AND LAYDOWN AREA

CIP - CAST IN PLACE ~OR~ CLEAN IN PLACE

CMU- CONCRETE MASONRY UNIT

PEP - POLYETHYLENE PIPE

Ø – DIAMETER

MIN - MINIMUM

GAL. - GALLON

APPROX. - APPROXIMATE

DWG - DRAWING

EL - ELEVATION

NTS - NOT TO SCALE

MnDOT - MINNESOTA DEPARTMENT OF TRANSPORTATION

HDPE - HIGH DENSITY POLYETHYLENE RCP - REINFORCED CONCRETE PIPE

GCL - GEOSYNTHETIC CLAY LINER

DIP - DUCTILE IRON PIPE

FFF - FINISHED FLOOR FLEVATION

MIL - MILLIMETER

RTH - RAIL TRANSFER HOPPER

EQ - EQUALIZATION

DRAWING NUMBERING

PLANT DRAWING NUMBER:

POLYMET

CMB2

JSU

23/69-0029

AS SHOWN

MINE SITE WWTF

LEGEND, ABBREVIATIONS, AND DRAWING INDEX

BARR

WWTF-002

POLY MET MINING, INC.

NORTHMET PROJECT

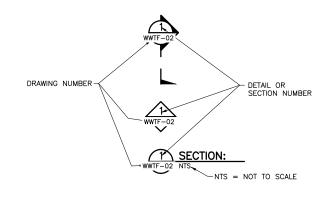
HOYT LAKES, MINNESOTA

BARR ENGINEERING COMPANY

4700 WEST 77TH STREET

MINNEAPOLIS, MN.

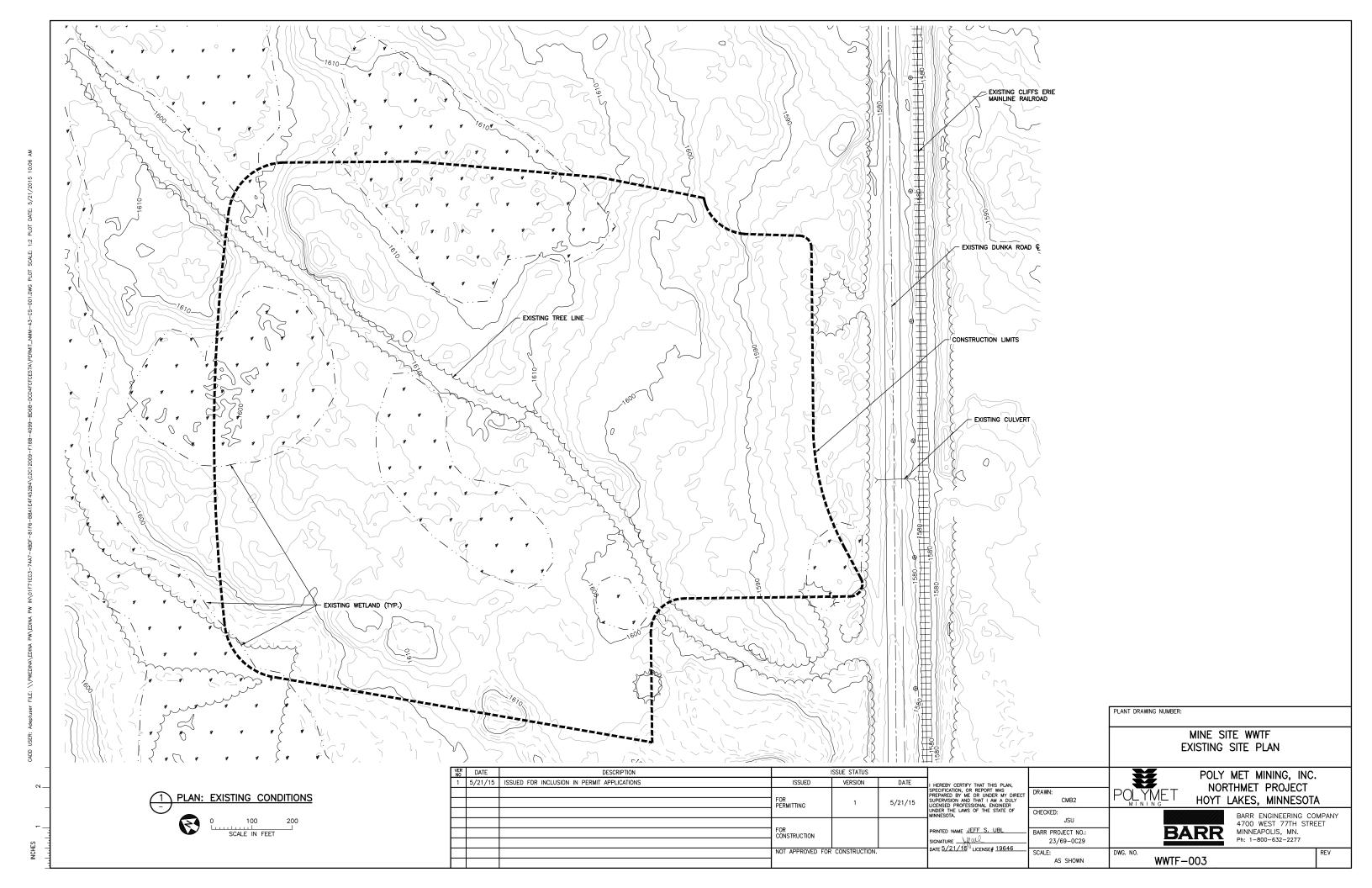
Ph: 1-800-632-2277

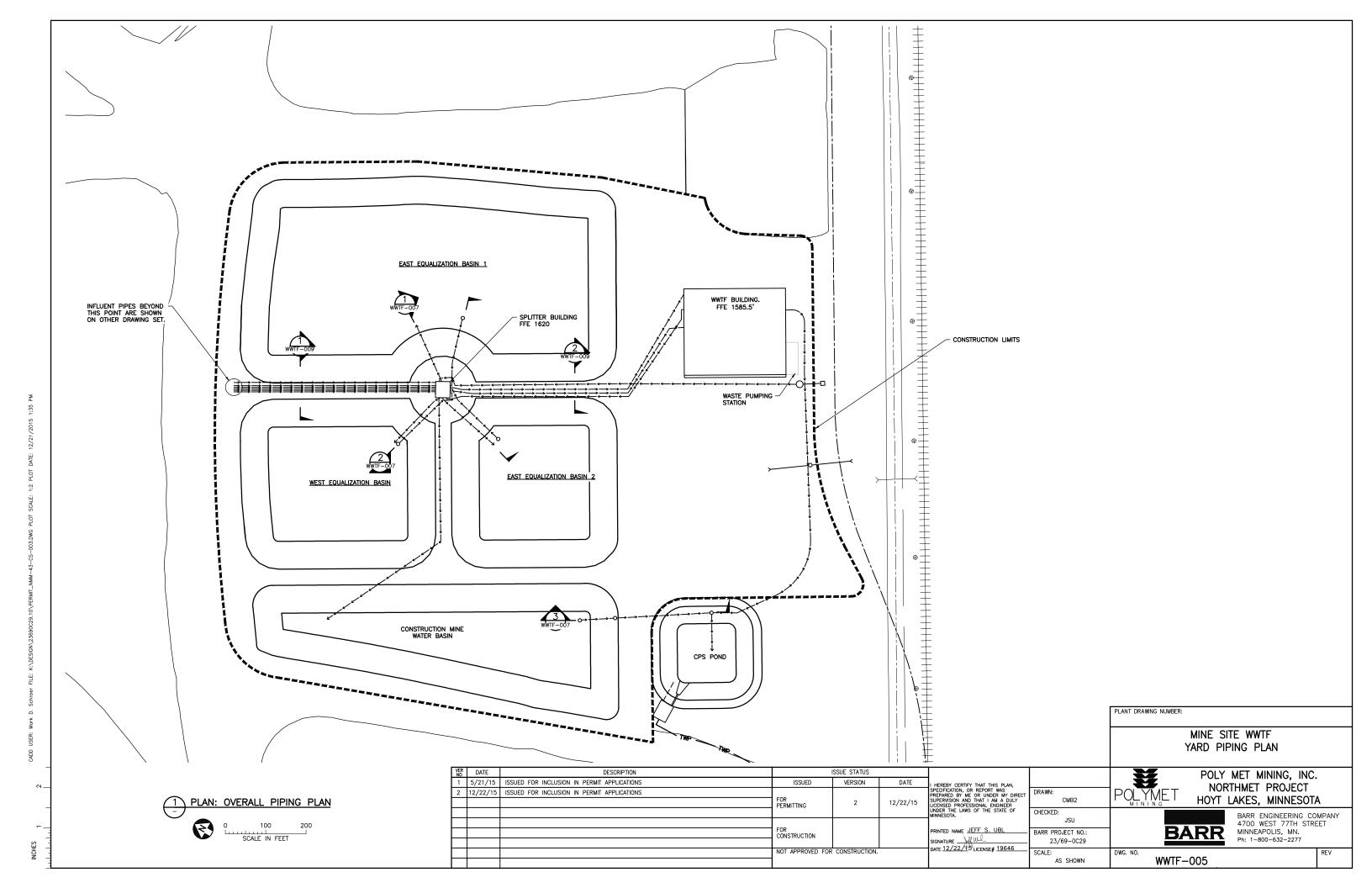


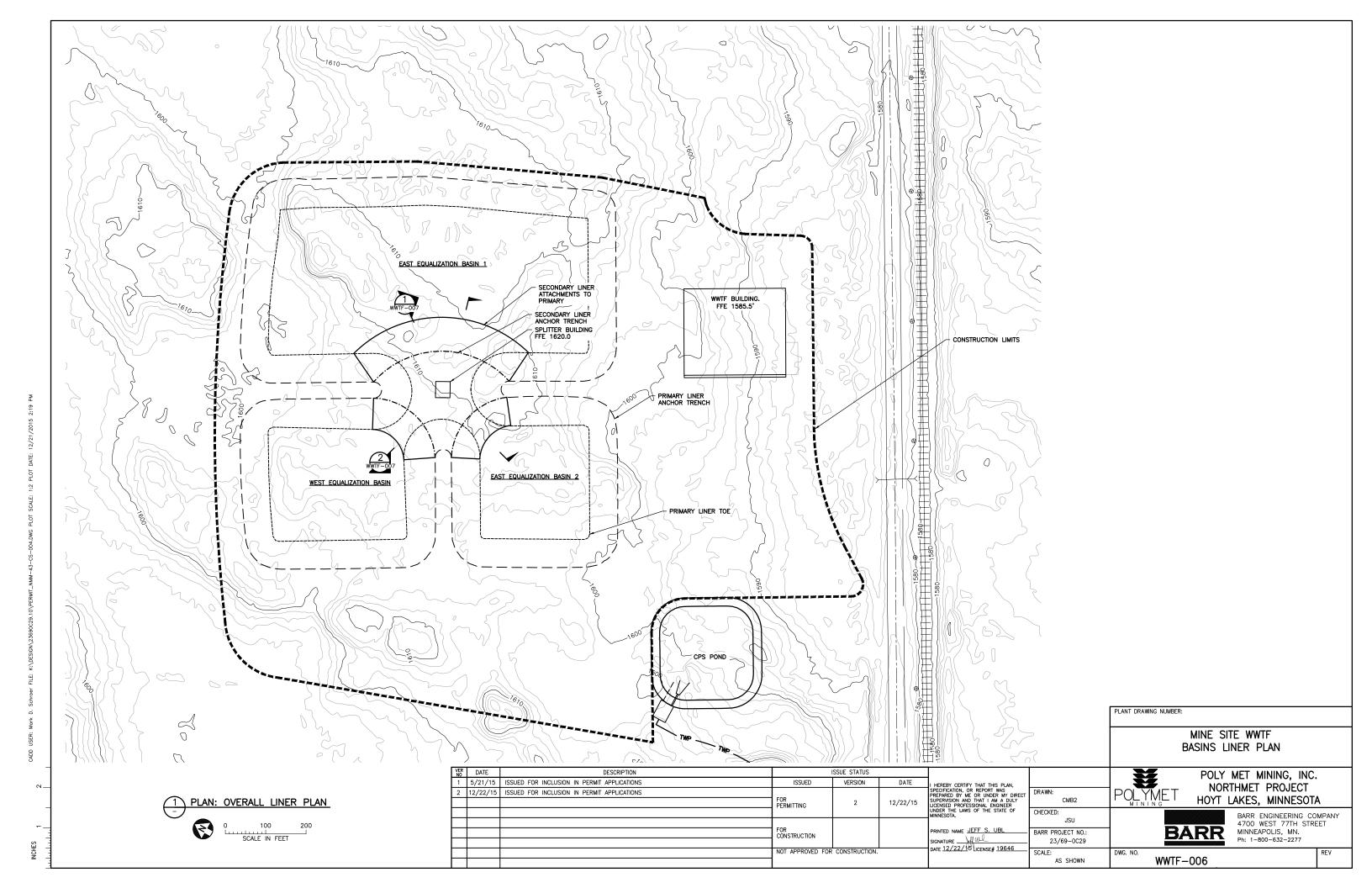
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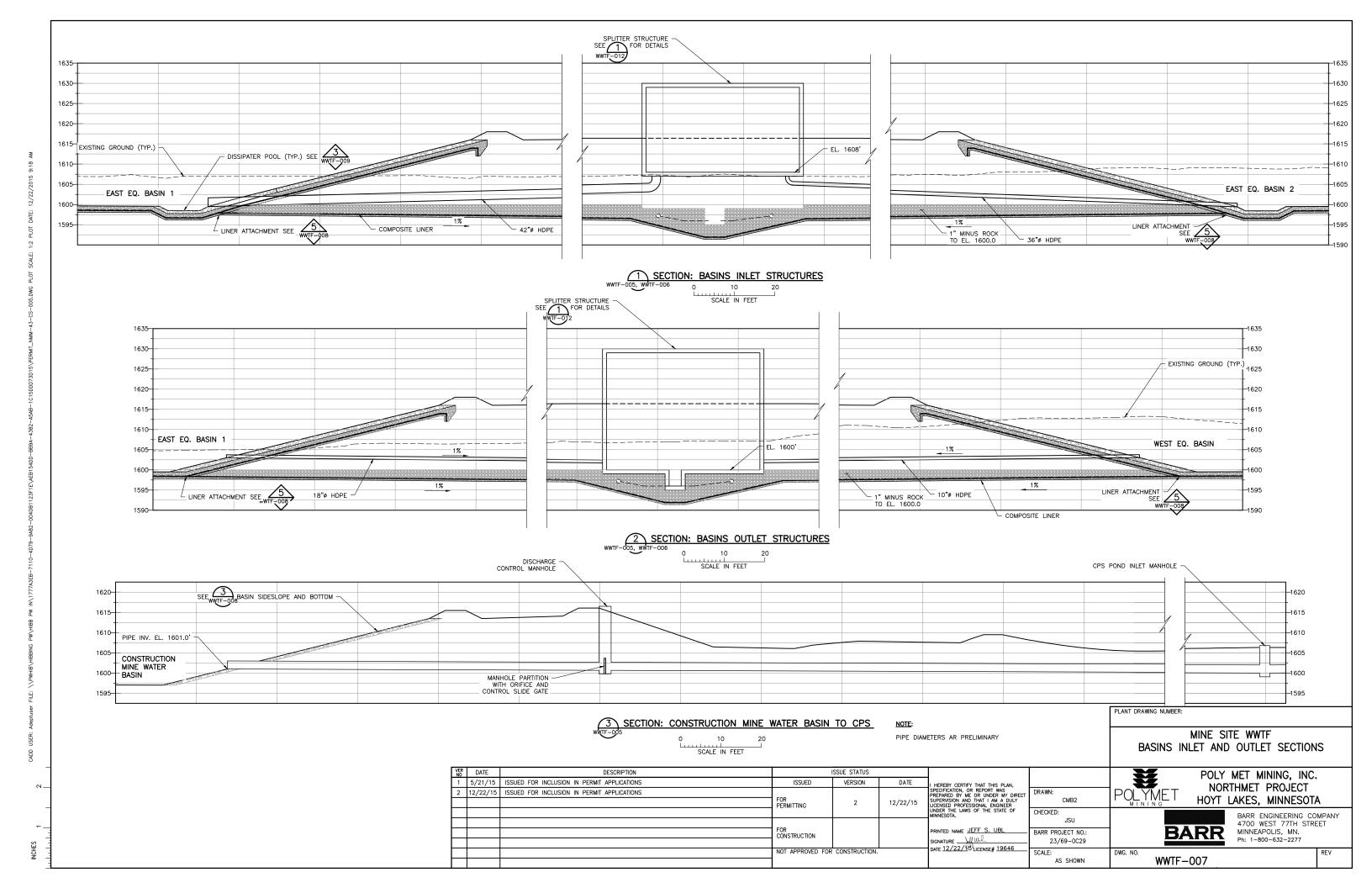
- 1. COORDINATE SYSTEM IS MINNESOTA STATE PLANE NORTH ZONE,
- 2. ELEVATIONS ARE MEAN SEA LEVEL (MSL), NAVD88.
- 3 EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010.
- 4. ALL EXISTING SUBSURFACE UTILITY INFORMATION SHOWN ON DRAWINGS SHALL BE CONSIDERED QUALITY LEVEL D (QL-D) AS DEFINED BY THE STANDARD GUIDELINES FOR THE COLLECTION DEPICTION OF EXISTING SUBSURFACE UTILITY DATA (ASCE, 2003) UNLESS OTHERWISE SPECIFIED.

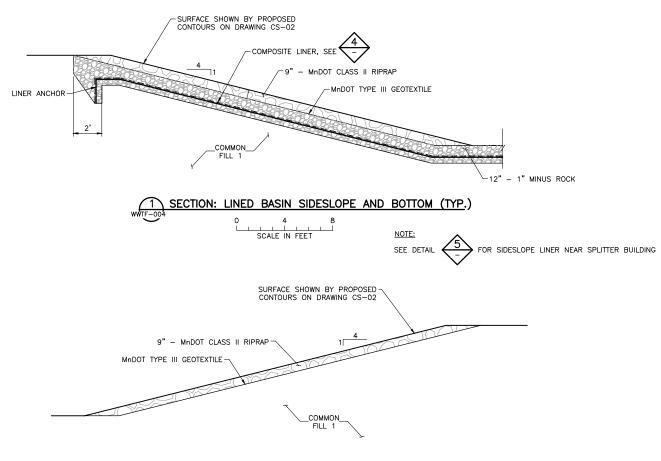
VER DATE DESCRIPTION ISSUE STATUS HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS SPECIFICATION, OR REPORT WAS USED THE SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF THAT THE LAWS OF THE STATE OF 1 10/18/11 WATER MANAGEMENT PLAN SUBMITTAL ISSUED VERSION DATE 2 5/21/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS DRAWN: FOR PERMITTING 3 12/22/15 ISSUED FOR INCLUSION IN PERMIT APPLICATIONS 12/22/15 CHECKED: FOR CONSTRUCTION RINTED NAME JEFF S. UBL BARR PROJECT NO. GIGNATURE AMUL DATE 12/22/15 LICENSE# 19646 NOT APPROVED FOR CONSTRUCTION.

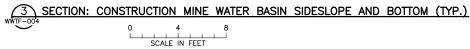


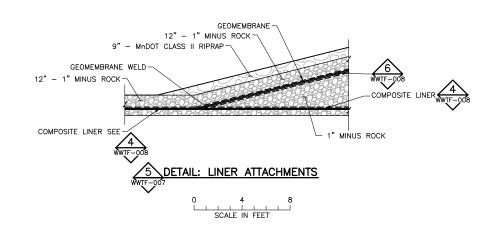


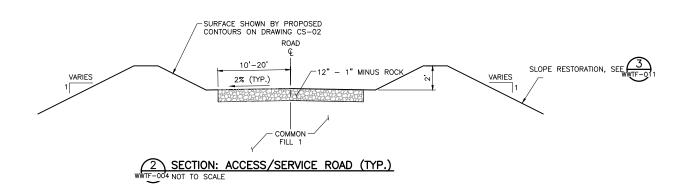


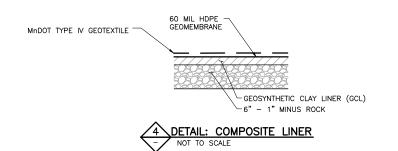


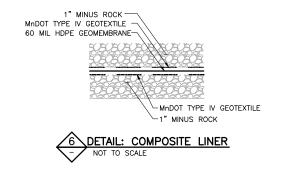












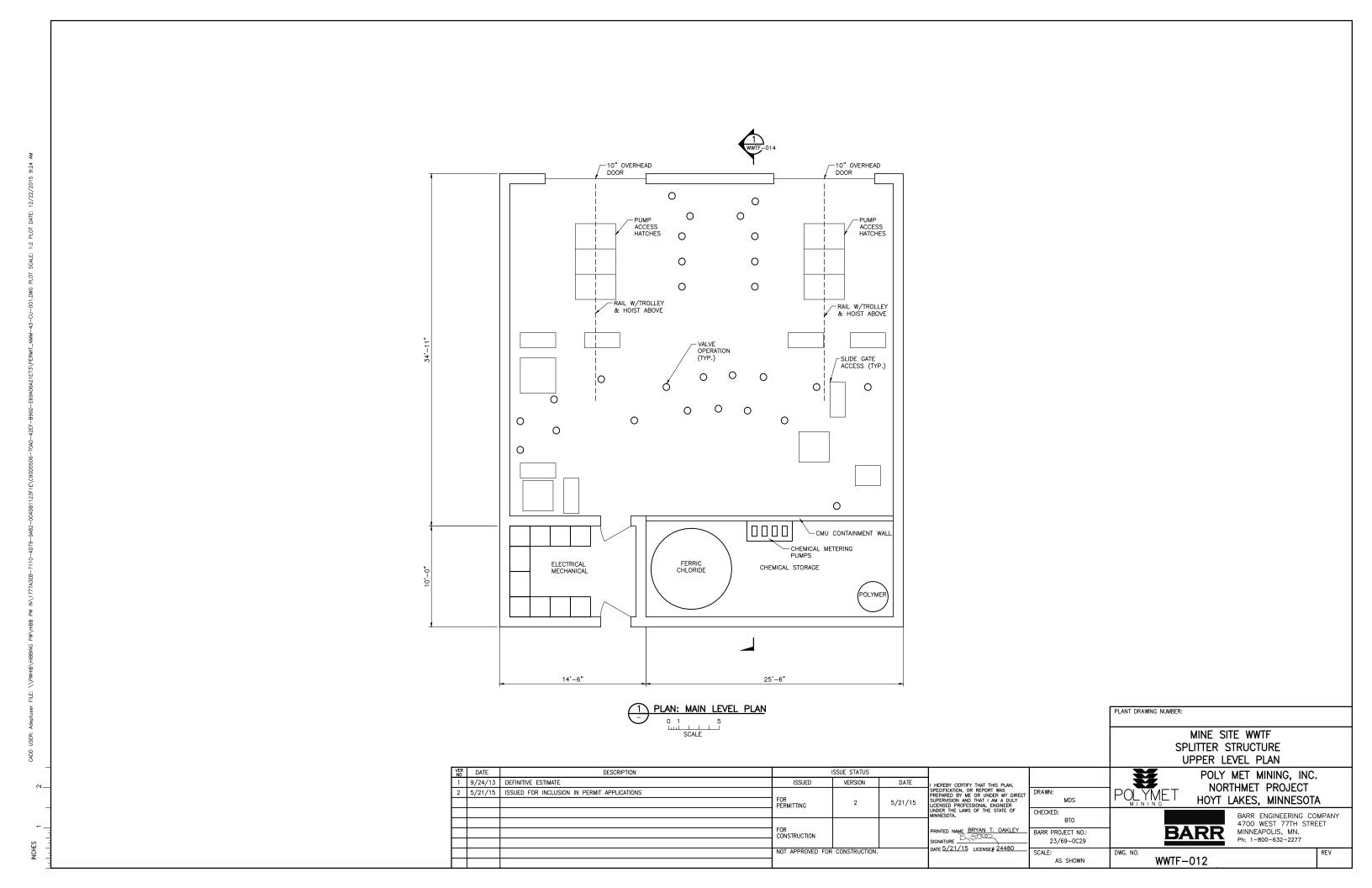
MINE SITE WWTF BASINS — SECTIONS AND DETAILS

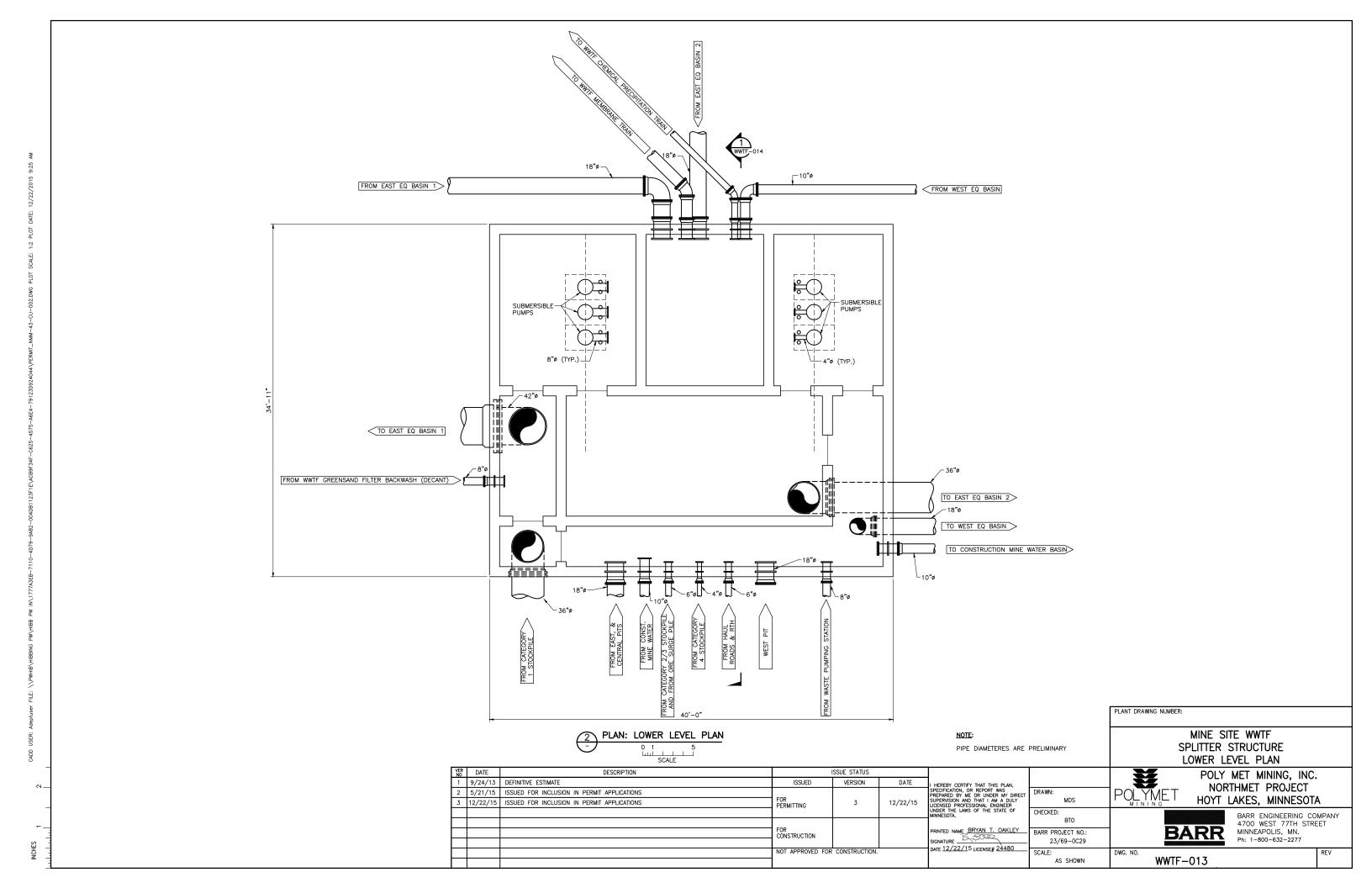
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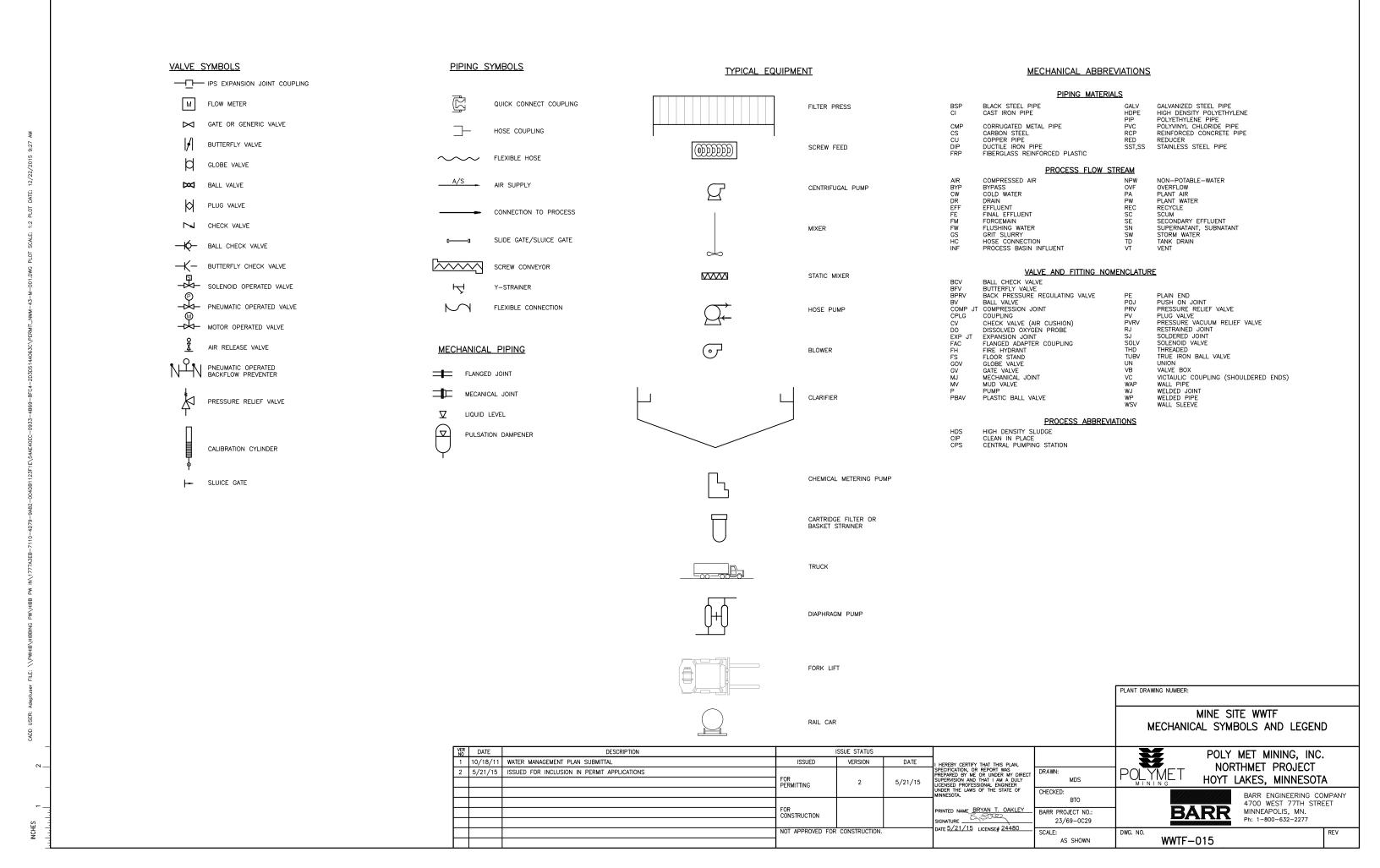
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1	10/18/11	WATER MANAGEMENT PLAN SUBMITTAL	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.		3	NORTHMET PROJECT	
2	9/24/13	DEFINITIVE ESTIMATE				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT	DRAWN:	POLYMET		
3	5/21/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	FOR PERMITTING	4	12/22/15	SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	CMB2	MINING	HOYT LAKES, MINNESOTA	
4	12/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS				UNDER THE LAWS OF THE STATE OF MINNESOTA.	CHECKED:		BARR ENGINEERING COMPANY	
							JSU		4700 WEST 77TH STREET	
			FOR CONSTRUCTION		I	PRINTED NAME JEFF S. UBL	BARR PROJECT NO.:	BA	RR MINNEAPOLIS, MN.	
					SIGNATURE	23/69-0C29		Ph: 1-800-632-2277		
			NOT APPROVED FOR	CONSTRUCTION.		DATE 12/22/15 LICENSE# 19646	SCALE:	DWG. NO.	REV	
\neg							AS SHOWN	l wwtf-	·008 I	

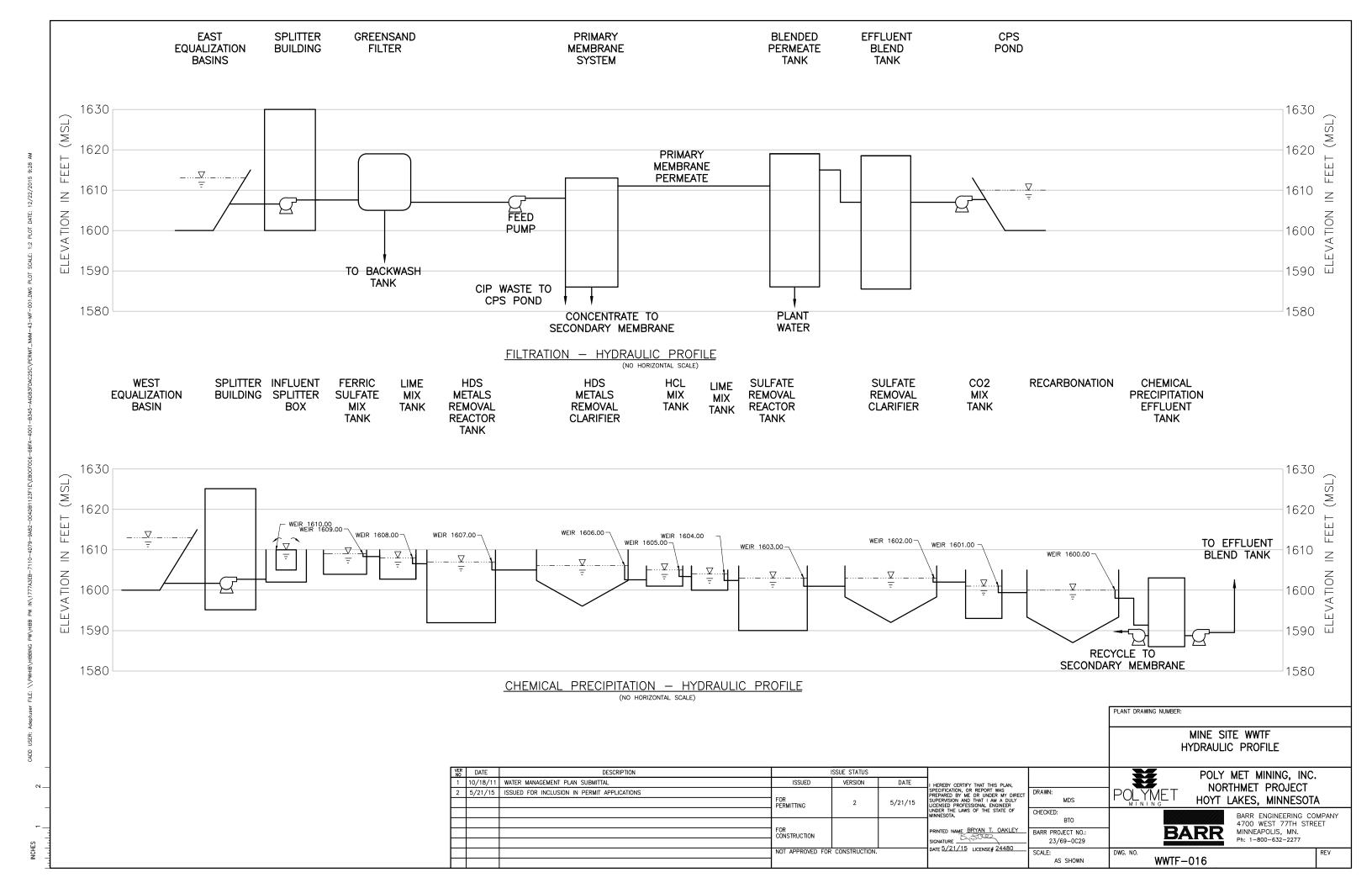
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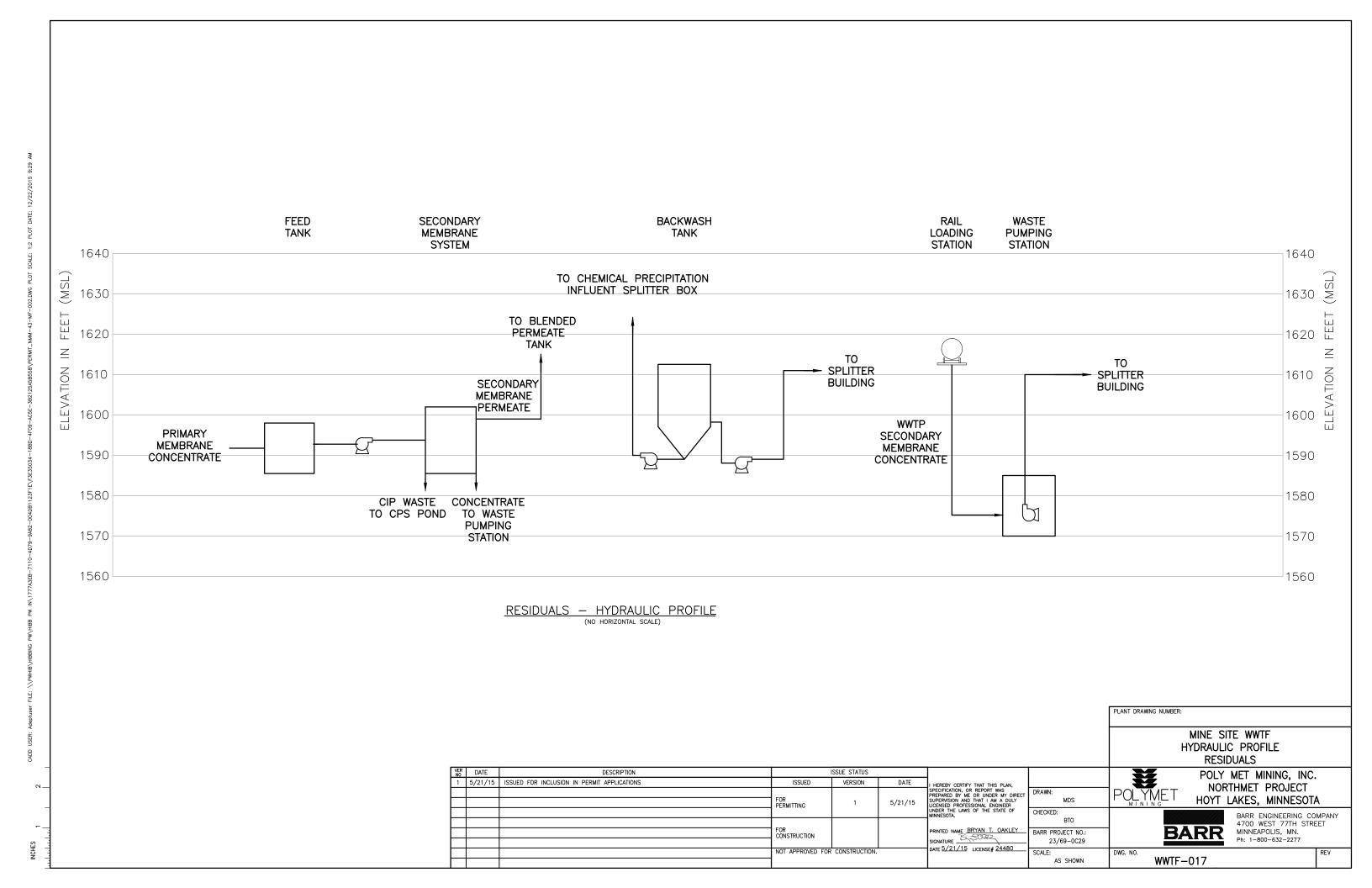
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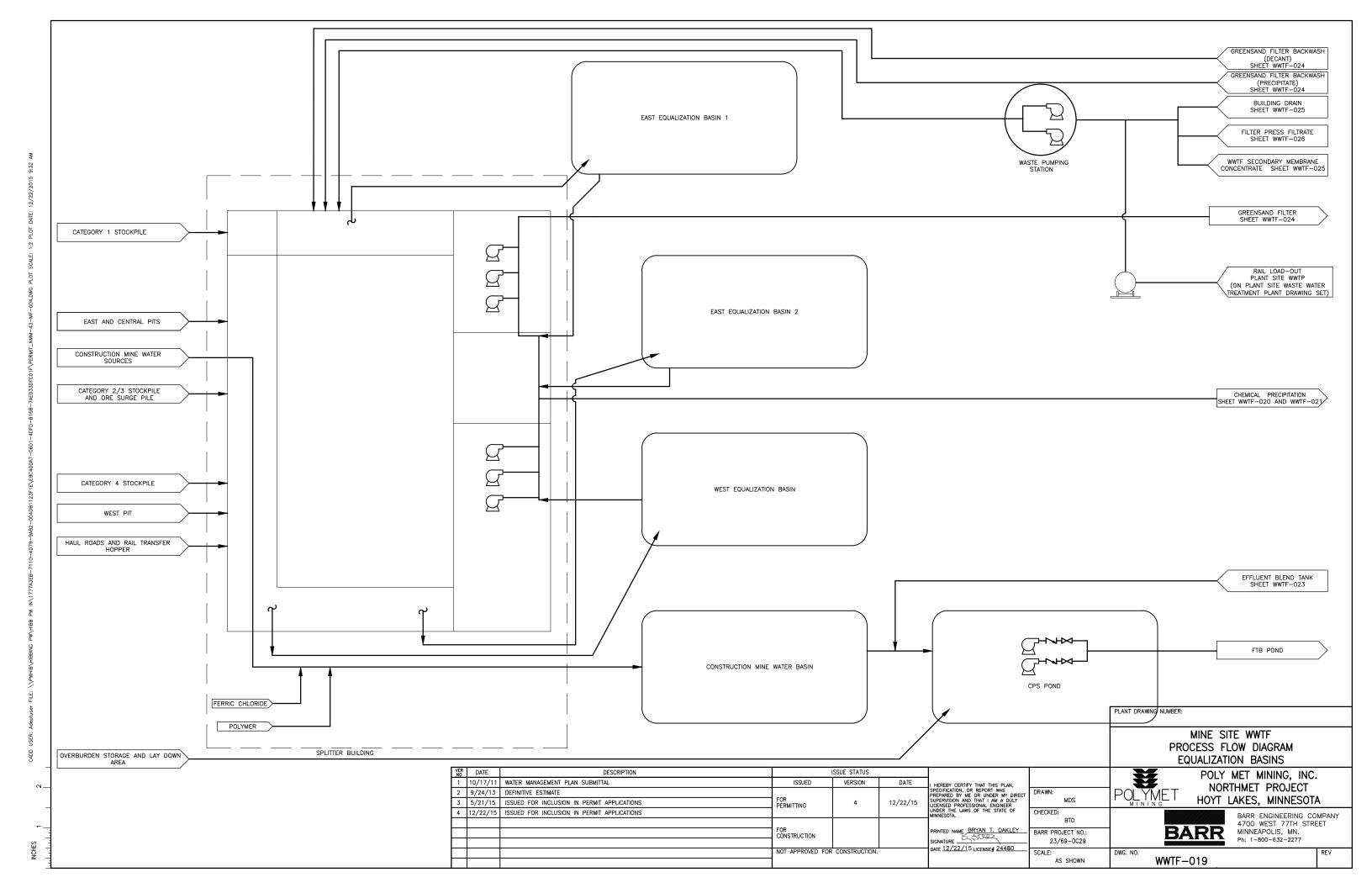


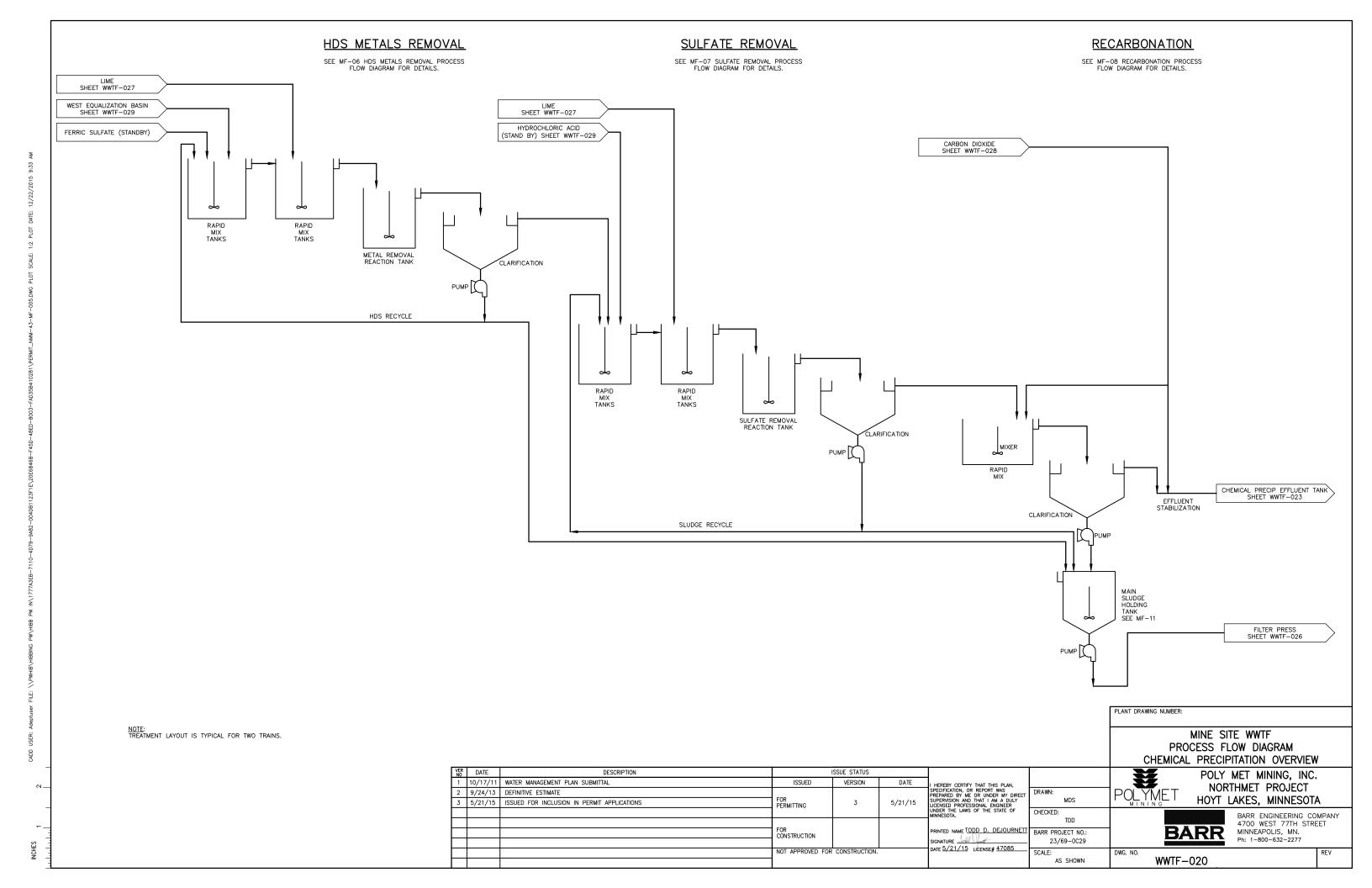


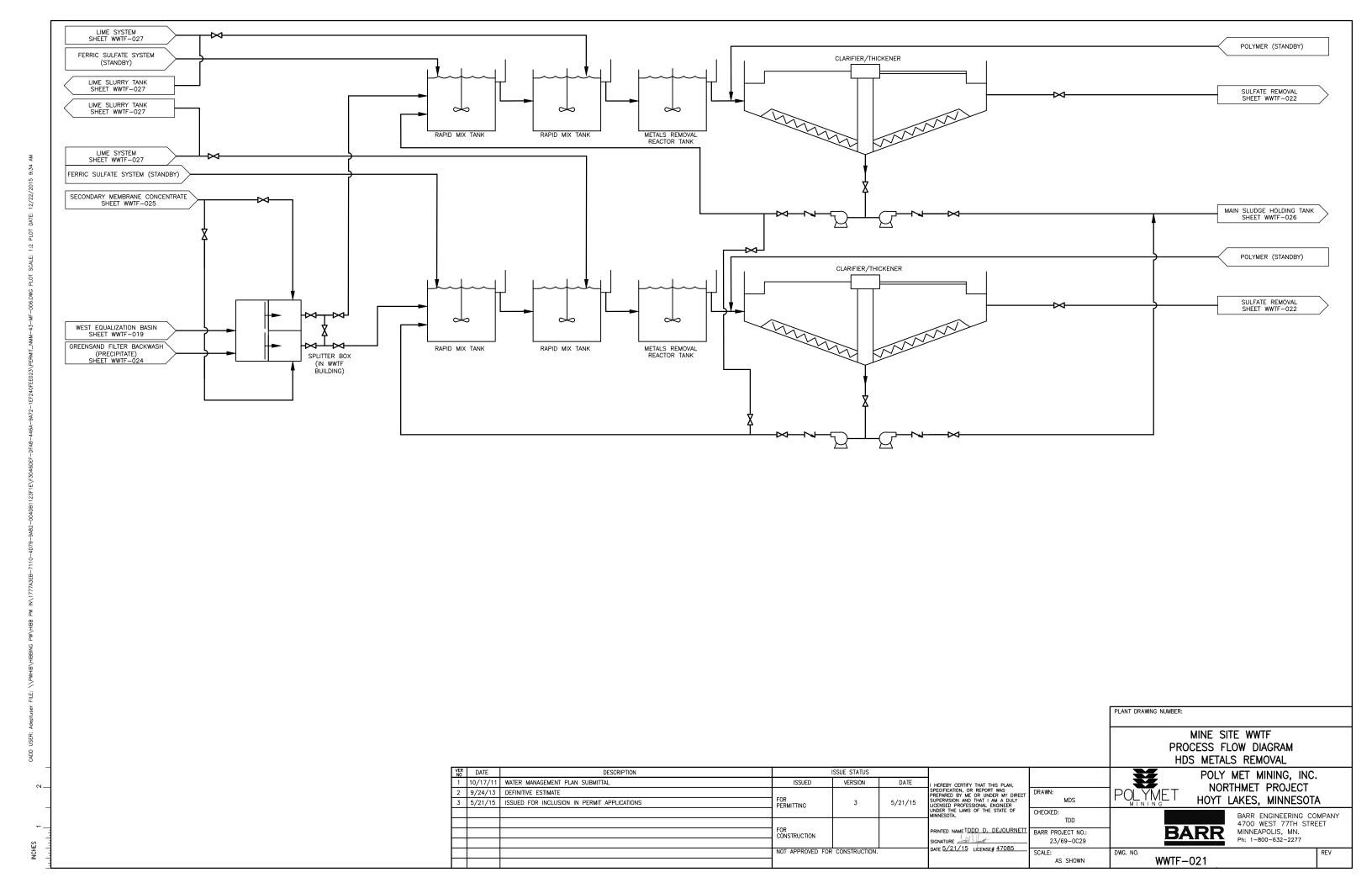


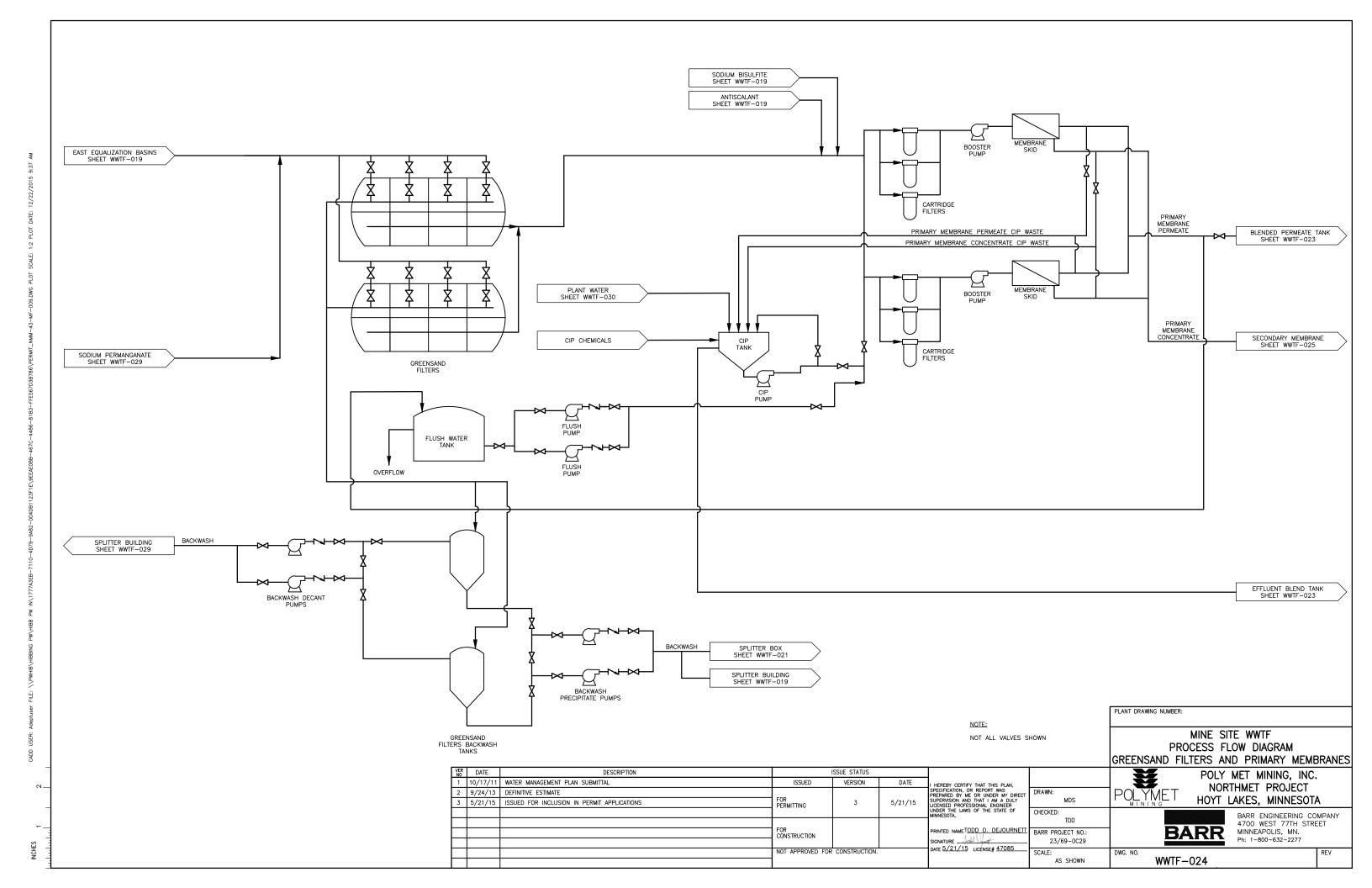


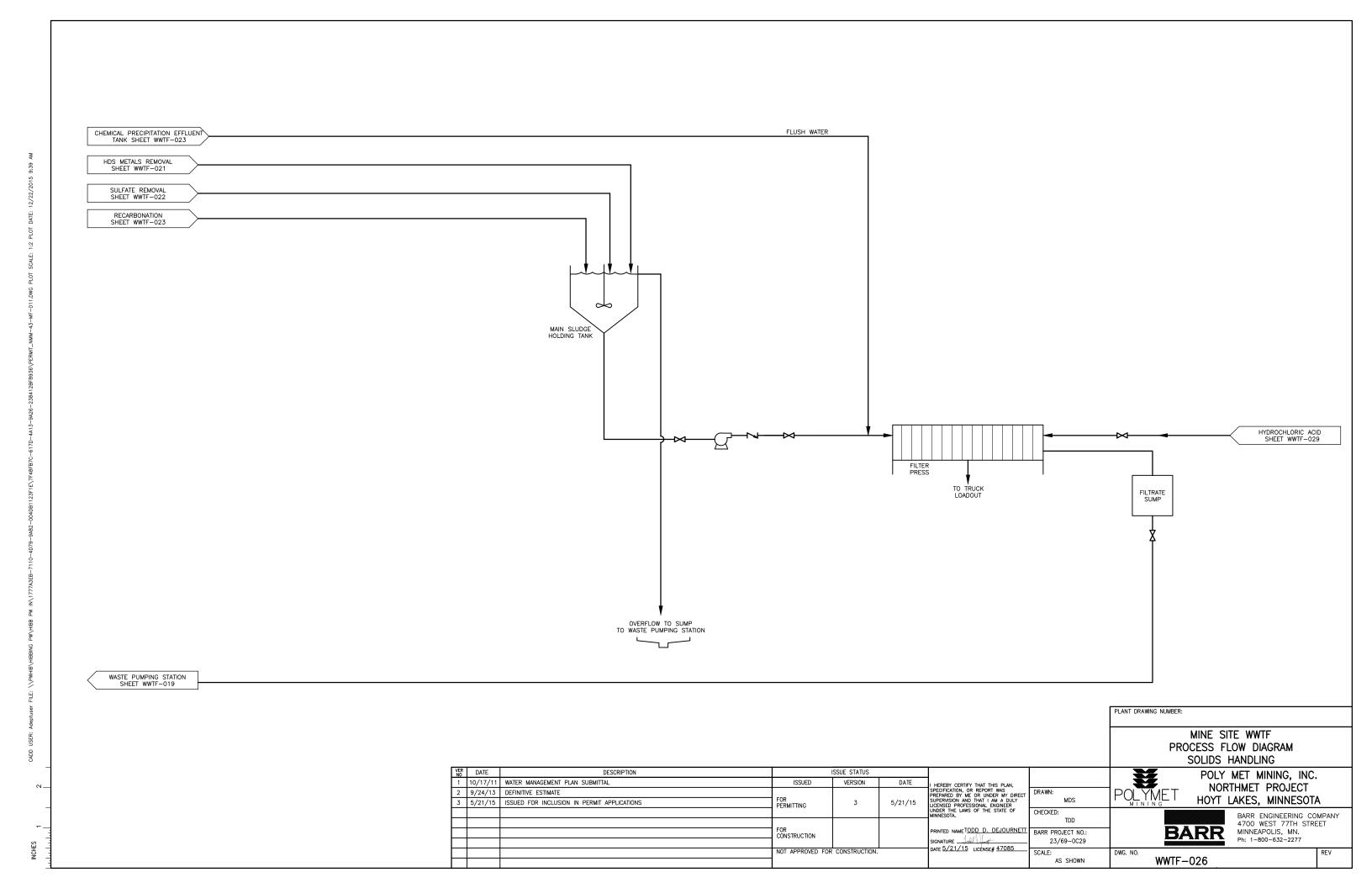


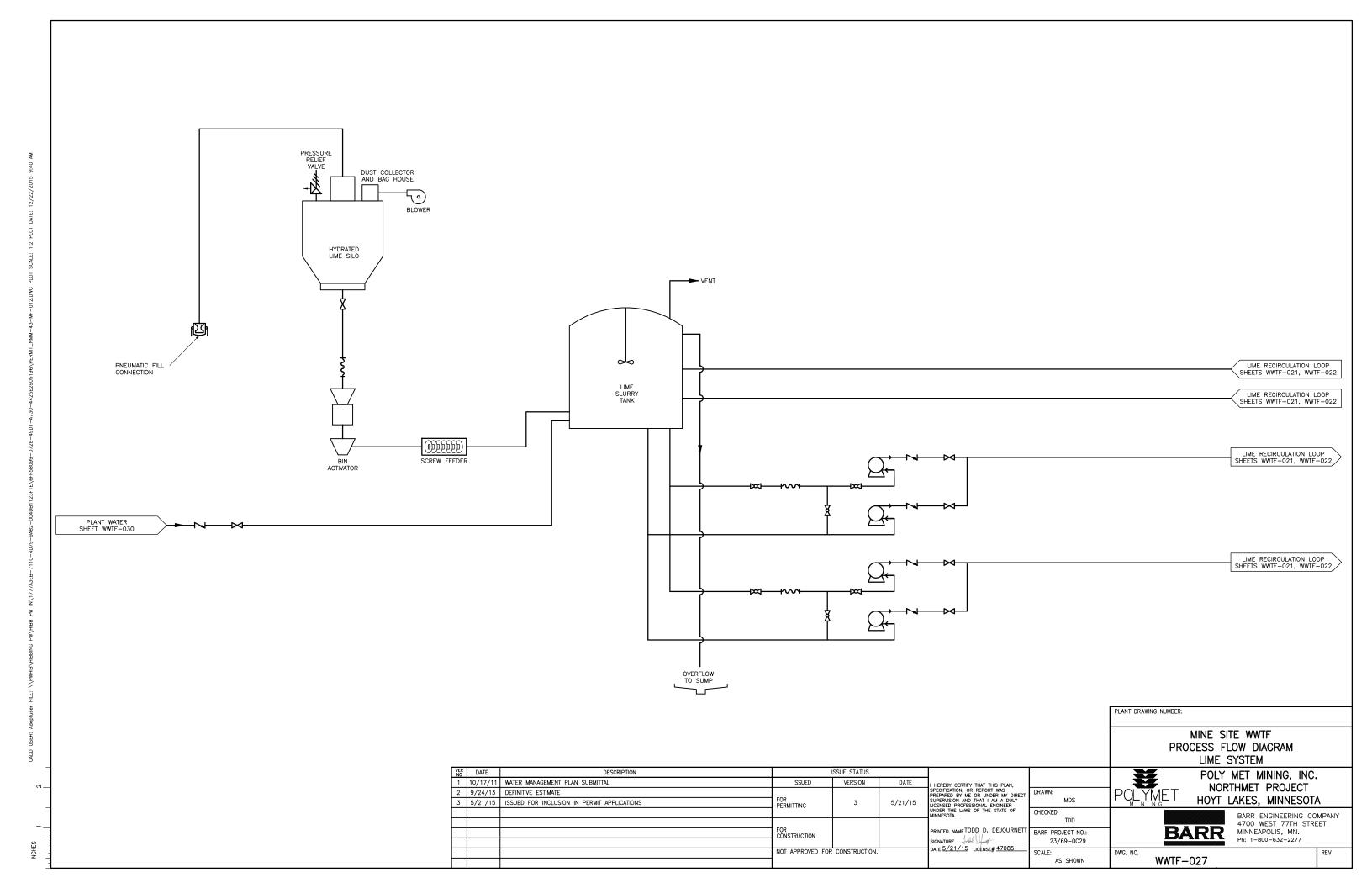


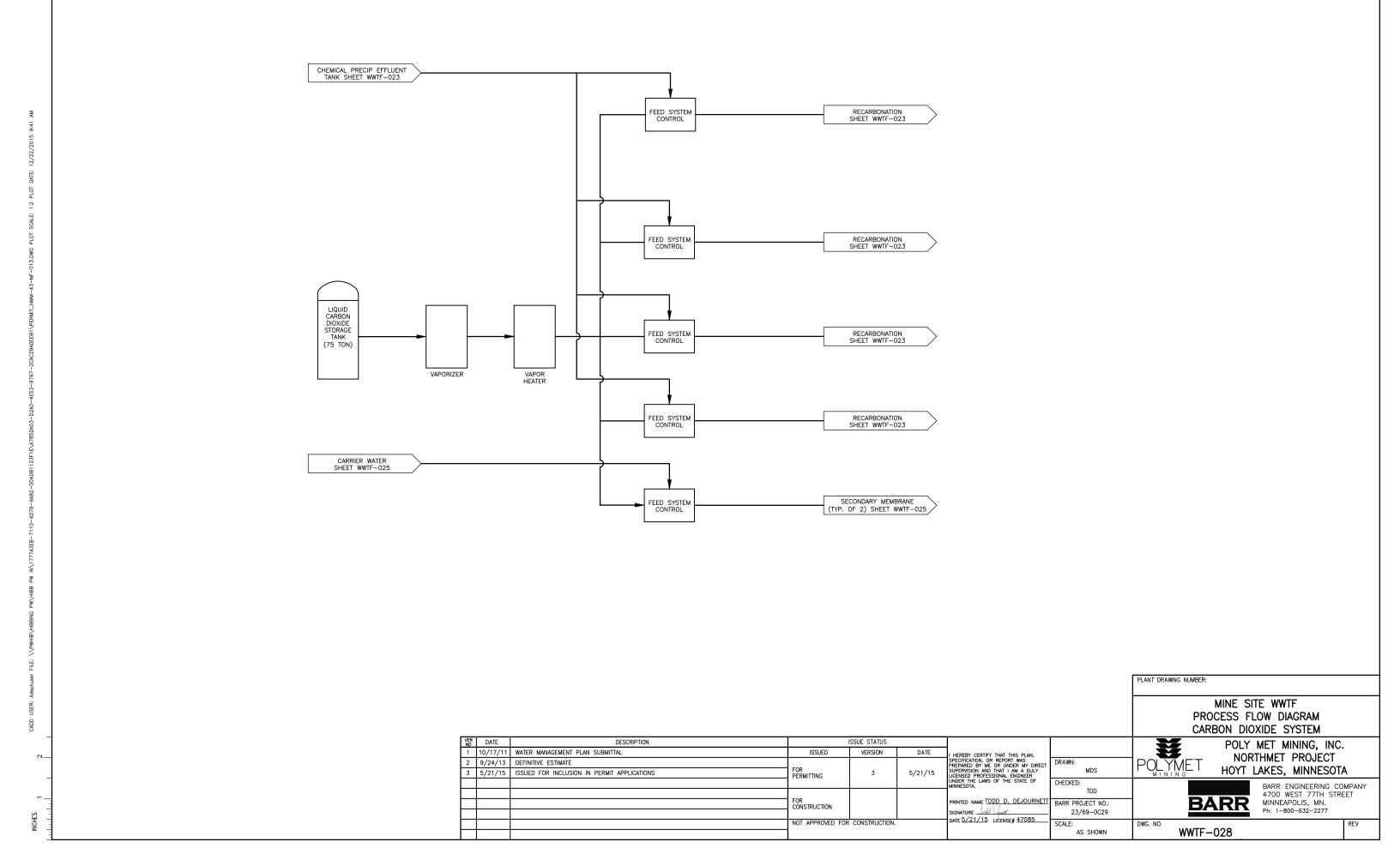


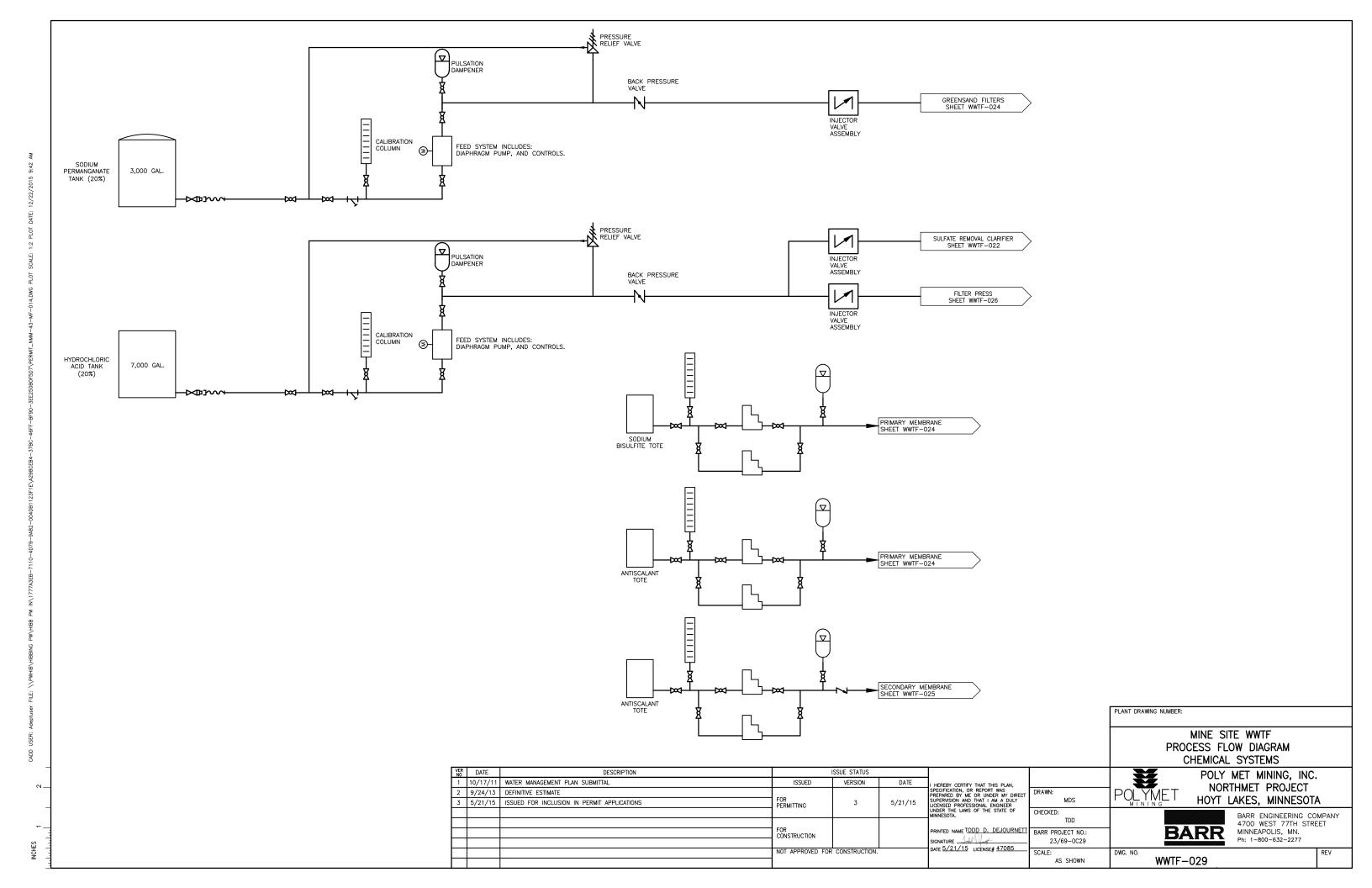


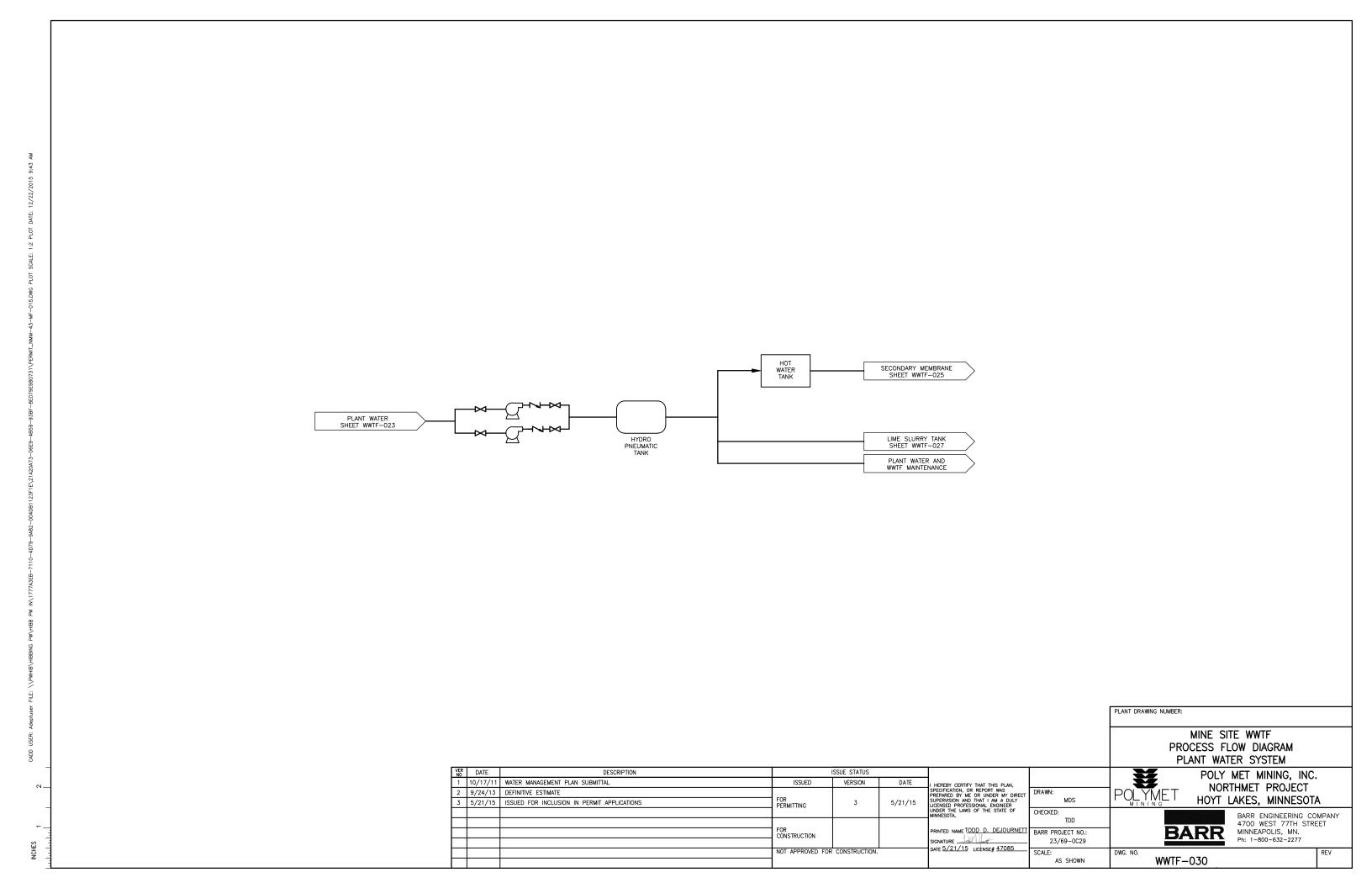


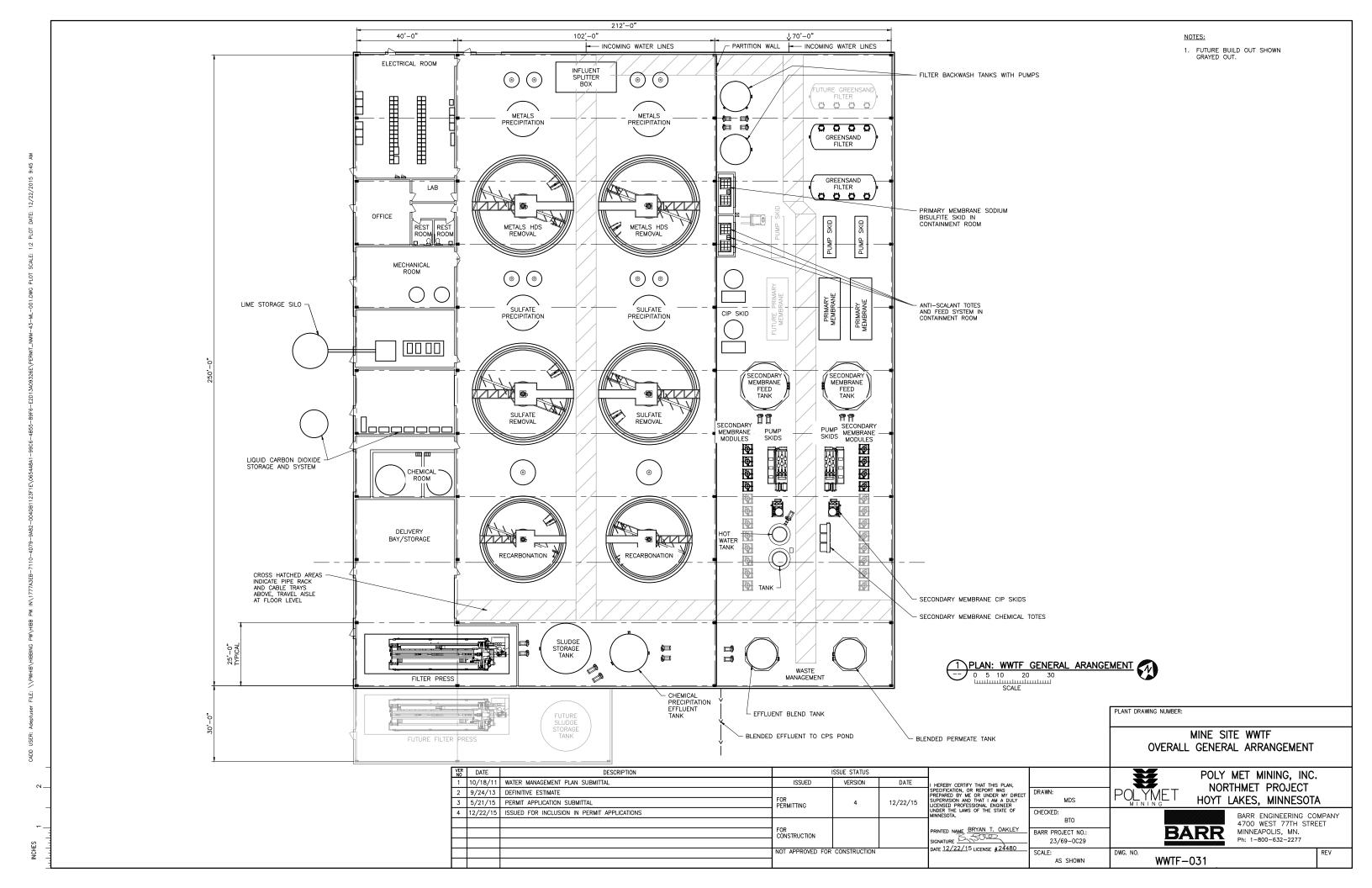


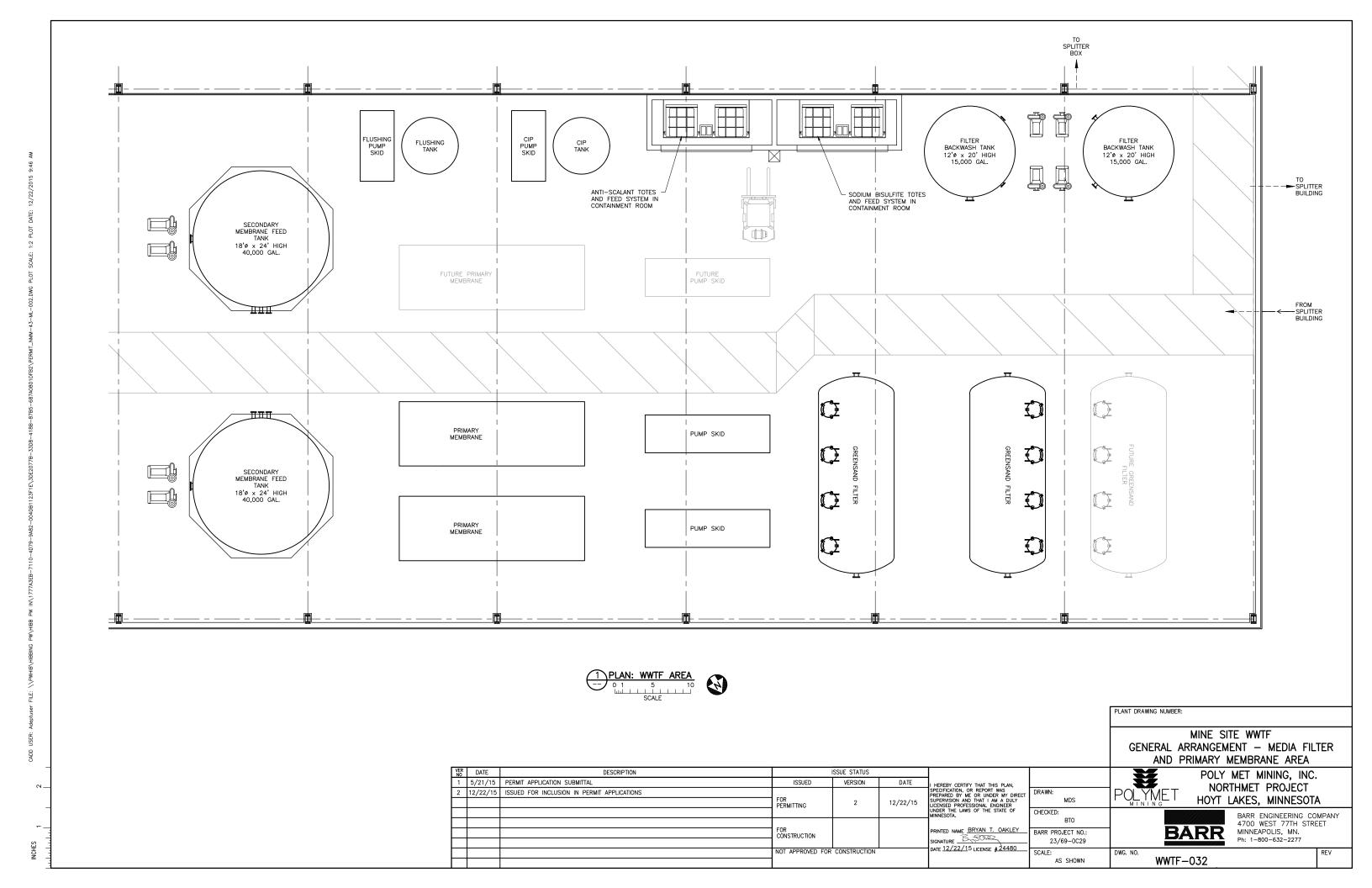


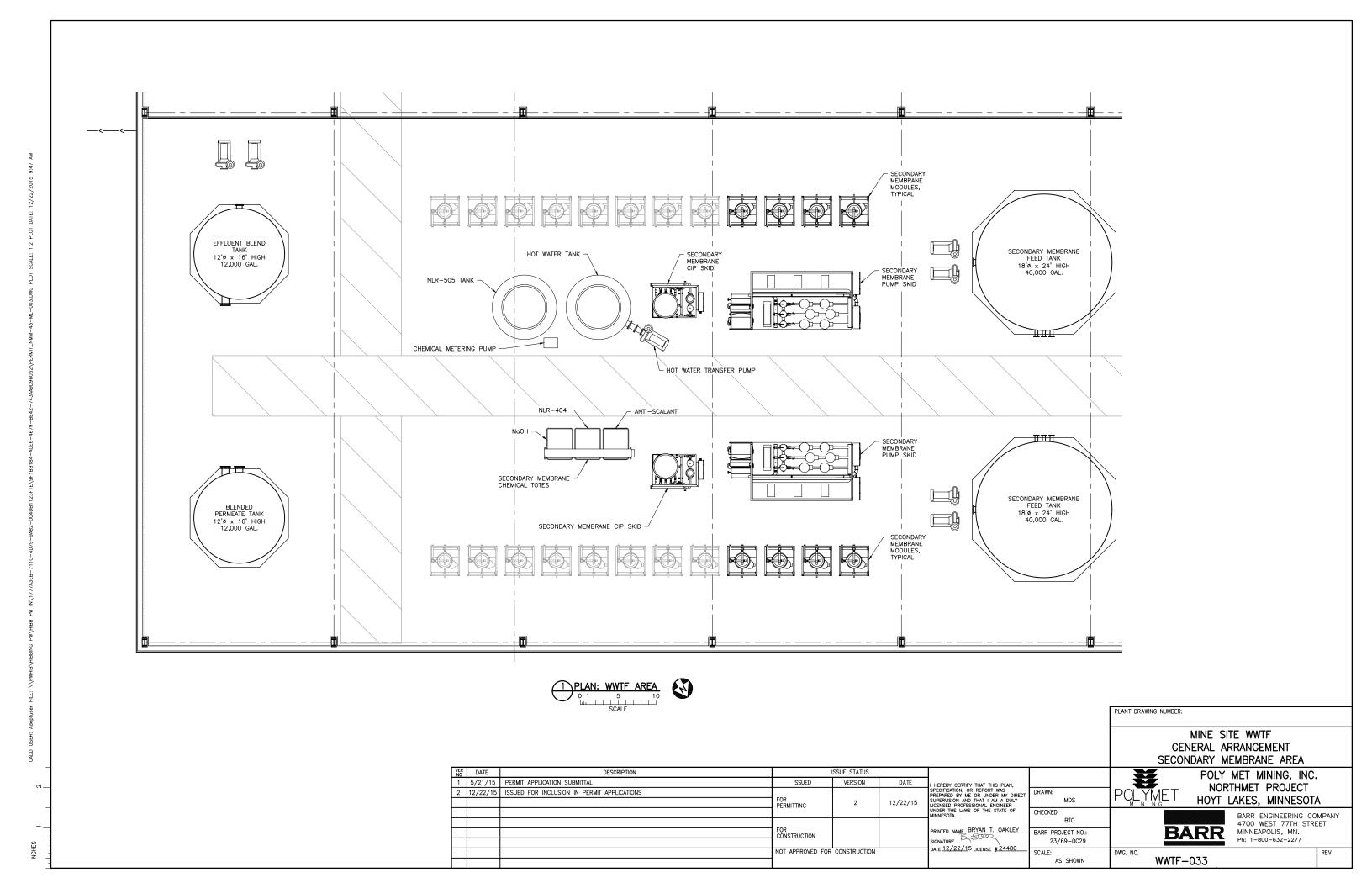


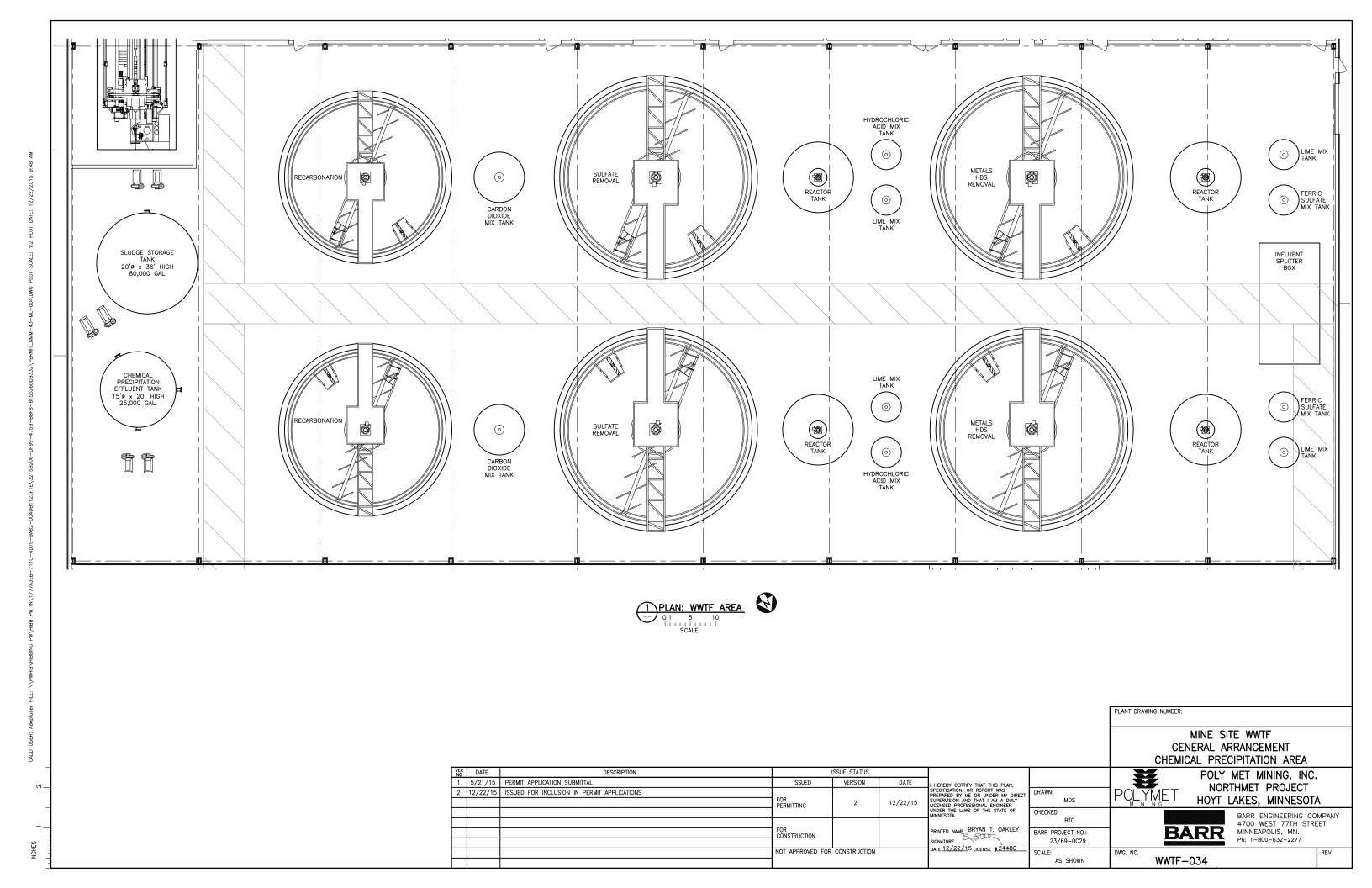


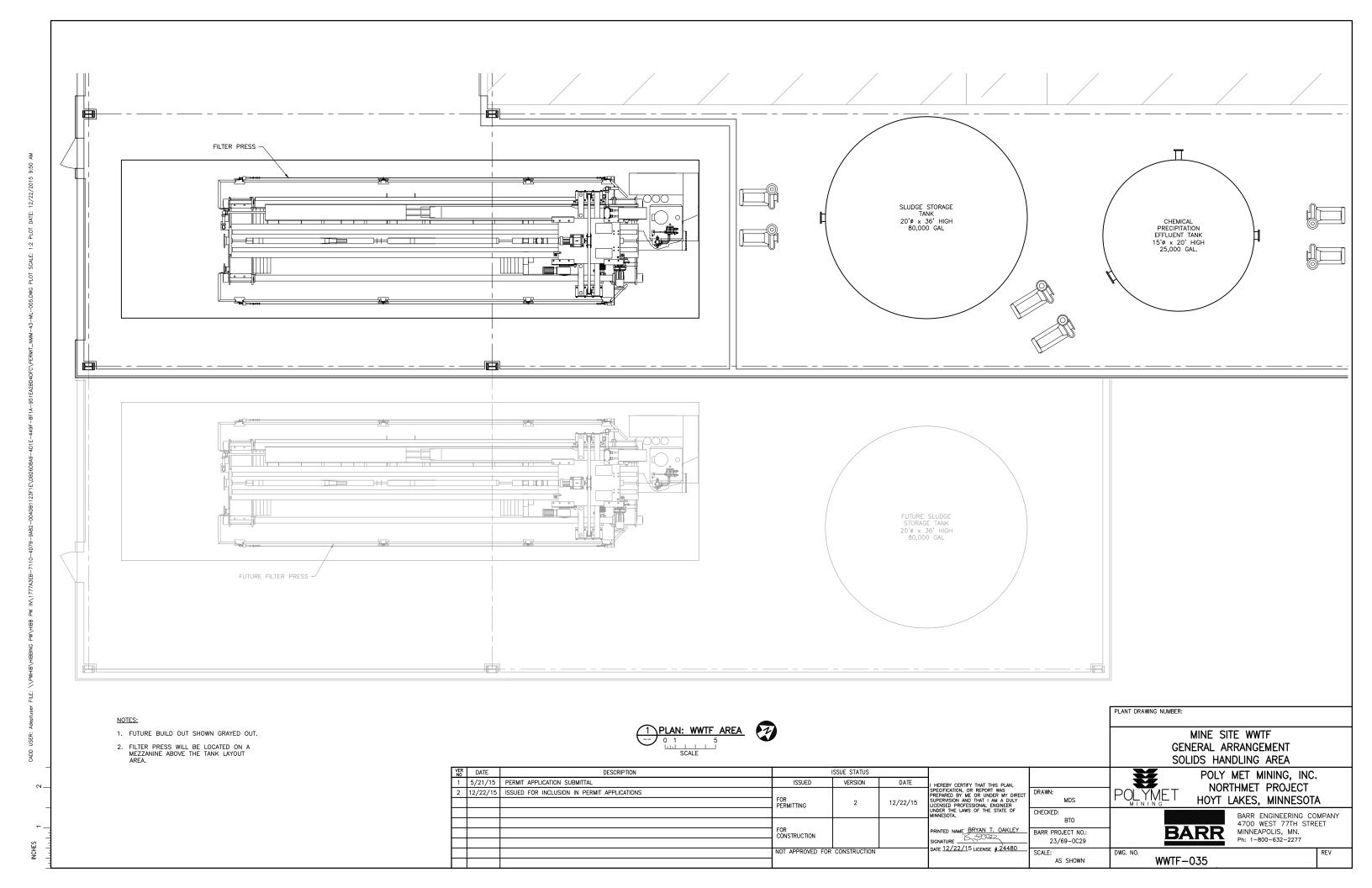


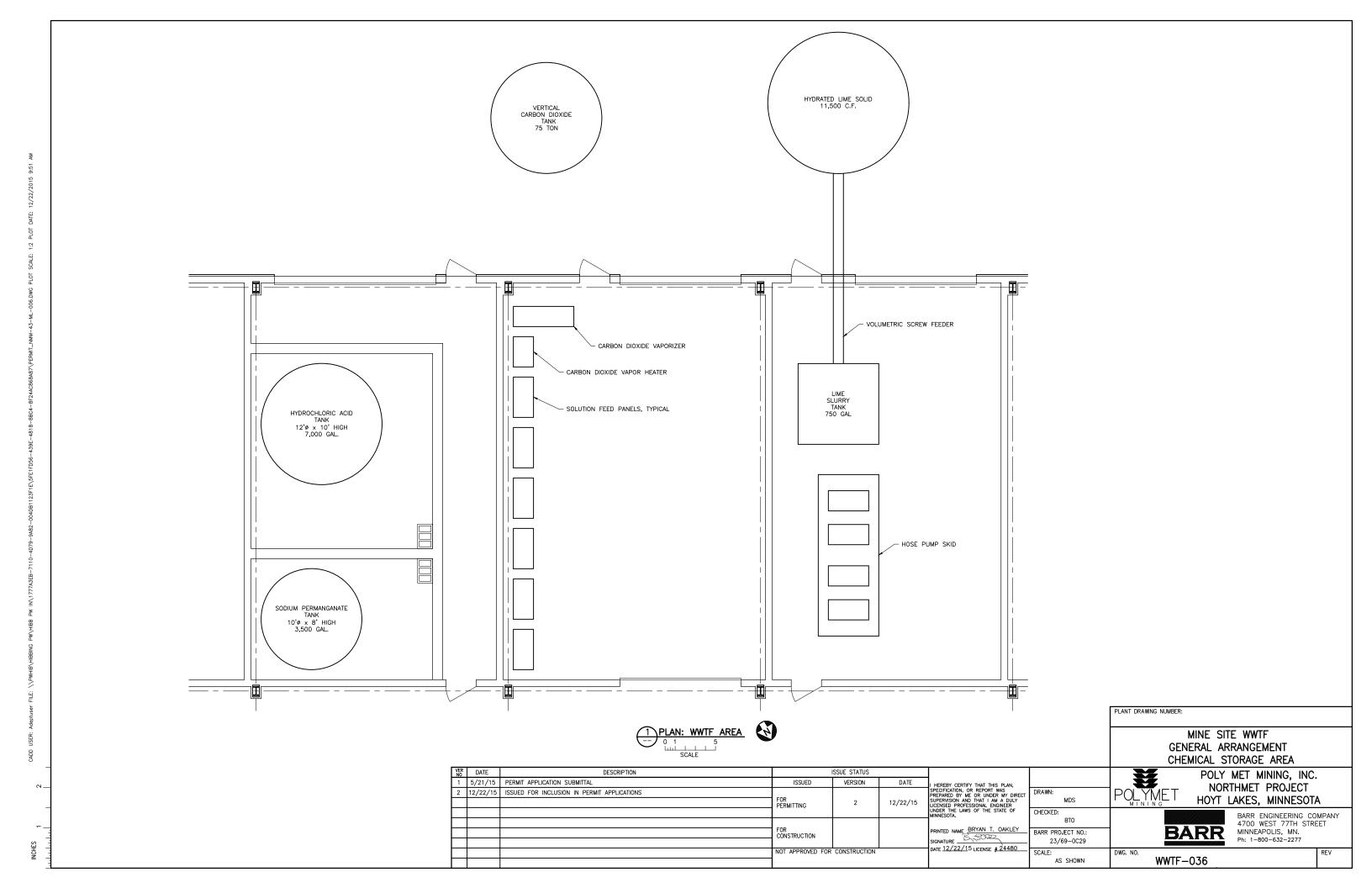




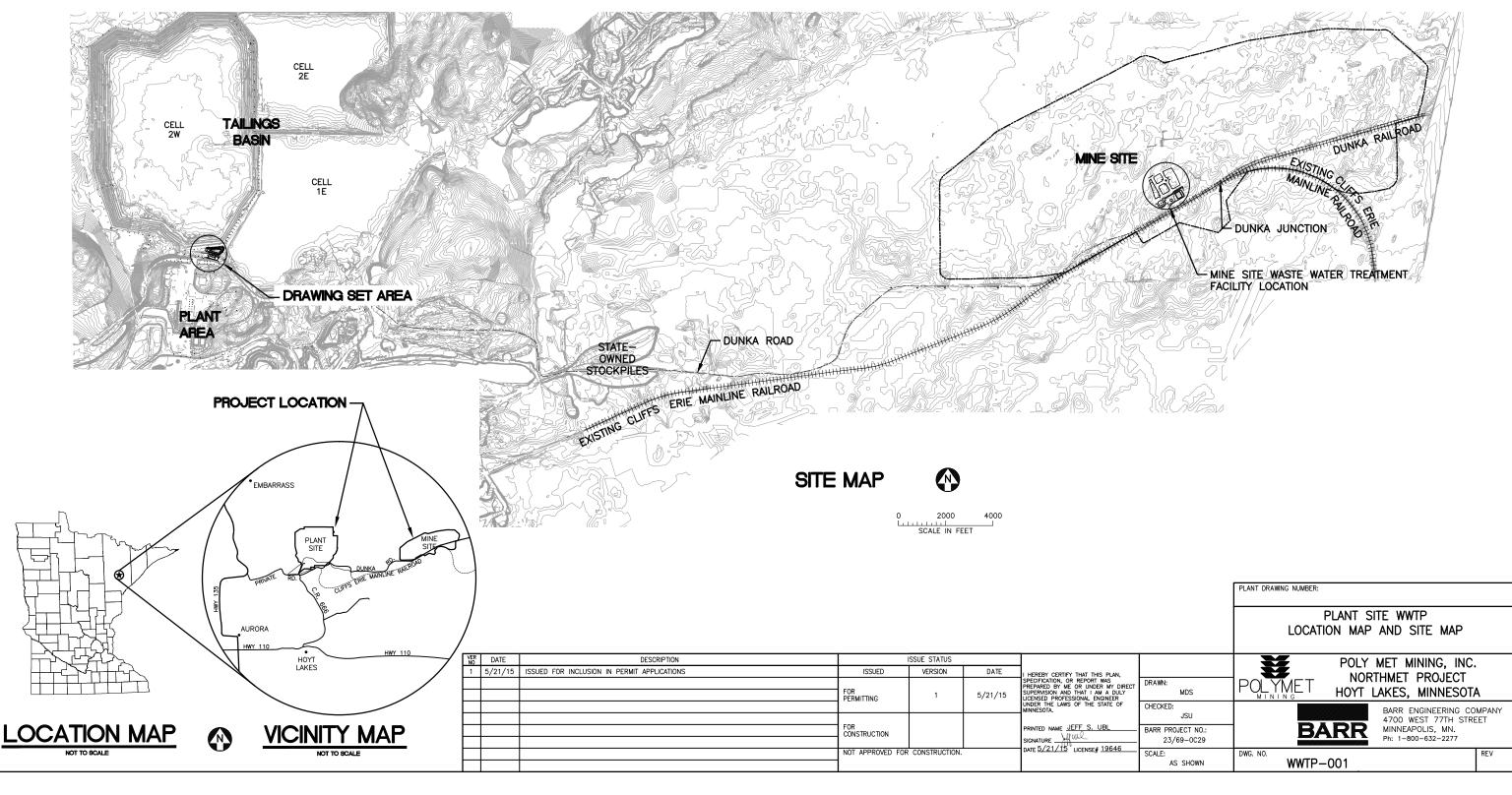












DRAWING INDEX

DRAWING NO.

TITLE SHEET

TITLE

LOCATION MAP AND SITE MAP LEGEND, ABBREVIATIONS, AND DRAWING INDEX WWTP-002

CIVIL -SITE WORK

WWTP-00.3 EXISTING SITE PLAN AND DEMOLITION WWTP-004 WWTP-005 WWTP-006 SITE GRADING PLAN AND CONSTRUCTION LIMITS
YARD PIPING PLAN
PRETREATMENT BASIN SECTIONS AND DETAILS WWTP-007 PRETREATMENT BASIN OUTLIET PLAN WWTP-008 WWTP-009 PRETREATMENT BASIN OUTLET SECTION NOT USED

WWTP-010 NOT USED

MECHANICAL MISCELLANEOUS

WWTP-011 MECHANICAL SYMBOLS AND LEGEND

MECHANICAL - FLOW SHEETS, P&IDs, ETC.

WWTP-012 HYDRAULIC PROFILE

WWTP-013 WWTP-014 PROCESS FLOW DIAGRAM PROCESS FLOW DIAGRAM PROCESS FLOW DIAGRAM - OVERVIEW
- PRETREATMENT, AND GREENSAND FILTERS
- PRIMARY MEMBRANES

WWTP-015 WWTP-016

PROCESS FLOW DIAGRAM – PRIMARY MEMBERANES
PROCESS FLOW DIAGRAM – SECONDARY MEMBERANES
PROCESS FLOW DIAGRAM – PERMEATE STABILIZATION AND STREAM AUGMENTATION
PROCESS FLOW DIAGRAM – LIQUID CHEMICAL STORAGE AND FEED
PROCESS FLOW DIAGRAM – WASTE LOAD—OUT
PROCESS FLOW DIAGRAM – CARBON DIOXIDE SYSTEM
PROCESS FLOW DIAGRAM – PLANT WATER SYSTEM

WWTP-019

1. COORDINATE SYSTEM IS BASED ON MINNESOTA STATE PLANE NORTH ZONE, NAD83.

3. EXISTING TOPOGRAPHIC INFORMATION SHOWN ON THE DRAWINGS WAS PREPARED BY AEROMETRIC, INC. FROM LIDAR DATA COLLECTED ON MARCH 17, 2010. 4. ALL EXISTING SUBSURFACE UTILITY INFORMATION SHOWN ON DRAWINGS SHALL BE

CONSIDERED QUALITY LEVEL D (QL-D) AS DEFINED BY THE STANDARD GUIDELINES FOR THE COLLECTION DEPICTION OF EXISTING SUBSURFACE UTILITY DATA (ASCE,

2. ELEVATIONS ARE BASED ON MEAN SEA LEVEL (MSL), NAVD88.

2003) UNLESS OTHERWISE SPECIFIED.

MECHANICAL -

NOTES:

WWTP-022

OVERALL GENERAL ARRANGEMENT
GENERAL ARRANGEMENT — MEDIA FILTER AND PRIMARY MEMBRANE AREA
GENERAL ARRANGEMENT — SECONDARY MEMBRANE AND LOAD—OUT AREA
GENERAL ARRANGEMENT — PERMEATE STABILIZATION AREA WWTP-023 WWTP-024

GENERAL LEGEND

EXISTING CONTOUR - MAJOR EXISTING CONTOUR - MINOR —1000 —— PROPOSED CONTOUR - MAJOR

PROPOSED CONTOUR - MINOR

 \otimes EXISTING POWER POLE

(1) UNIDENTIFIED

-----EXISTING RAILROAD EXISTING ROAD

FXISTING TRAIL

EXISTING UNIMPROVED TRAIL

EXISTING STRUCTURES

TREE LINE <u>علد</u> WETLAND BOUNDARY EXISTING CULVERT

MnDOT CATEGORY 4 EROSION CONTROL BLANKET

INLET PROTECTION AND DITCH CHECKS

PROPOSED RIPRAP

EXISTING PIPELINE

MnDOT TYPE 4 MULCH

PROPOSED CULVERT (NON-MINE DRAINAGE)

0 PROPOSED MANHOLE

PROPOSED SILT FENCE PROPOSED PIPELINE

CONSTRUCTION LIMITS

PROPOSED STRUCTURES

PROPOSED STRUCTURE EXPANSION

PROPOSED ROAD SURFACE DRAINAGE

TWP ALIGNMENT

GENERAL ABBREVIATIONS

TWP - TREATED WATER PIPELINE

CPS - CENTRAL PUMPING STATION

WWTP - WASTE WATER TREATMENT PLANT

WWTF - WASTE WATER TREATMENT FACILITY

OSLA - OVERBURDEN STORAGE AND LAYDOWN AREA

CATEGORY 1 STOCKPILE - CATEGORY 1 WASTE ROCK STOCKPILE

CIP - CAST IN PLACE ~OR~ CLEAN IN PLACE

CMU- CONCRETE MASONRY UNIT

PEP - POLYETHYLENE PIPE

APPROX. - APPROXIMATE

ø – DIAMETER MIN - MINIMUM

GAL. - GALLON

DWG - DRAWING

EL - ELEVATION

NTS - NOT TO SCALE

TYP - TYPICAL

MnDOT - MINNESOTA DEPARTMENT OF TRANSPORTATION

HDPE - HIGH DENSITY POLYETHYLENE

RCP - REINFORCED CONCRETE PIPE

GCL - GEOSYNTHETIC CLAY LINER

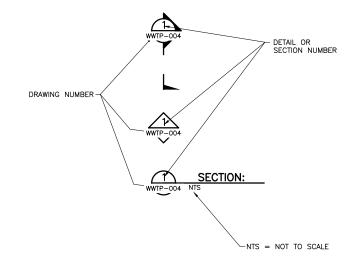
DIP - DUCTILE IRON PIPE

FFE - FINISHED FLOOR ELEVATION

MII - MILLIMETER

RTH - RAIL TRANSFER HOPPER

EQ - EQUALIZATION



PLANT SITE WWTP LEGEND, ABREVIATIONS, AND DRAWING INDEX

VER NO	DATE	DESCRIPTION	ISSUE STATUS					
1	5/21/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN,		
2	12/22/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS				SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.	DRAWN:	
			FOR PERMITTING	2	12/22/13		GWG	
							CHECKED:	
							BTO	
			FOR CONSTRUCTION			PRINTED NAME JEFF S. UBL	BARR PROJECT NO.:	
						SIGNATURE	23/69-0C29	
	·		NOT APPROVED FOR	CONSTRUCTION.		DATE 12/22/13 LICENSE# 19040	SCALE:	
							AS SHOWN	

POLYMET

PLANT DRAWING NUMBER:

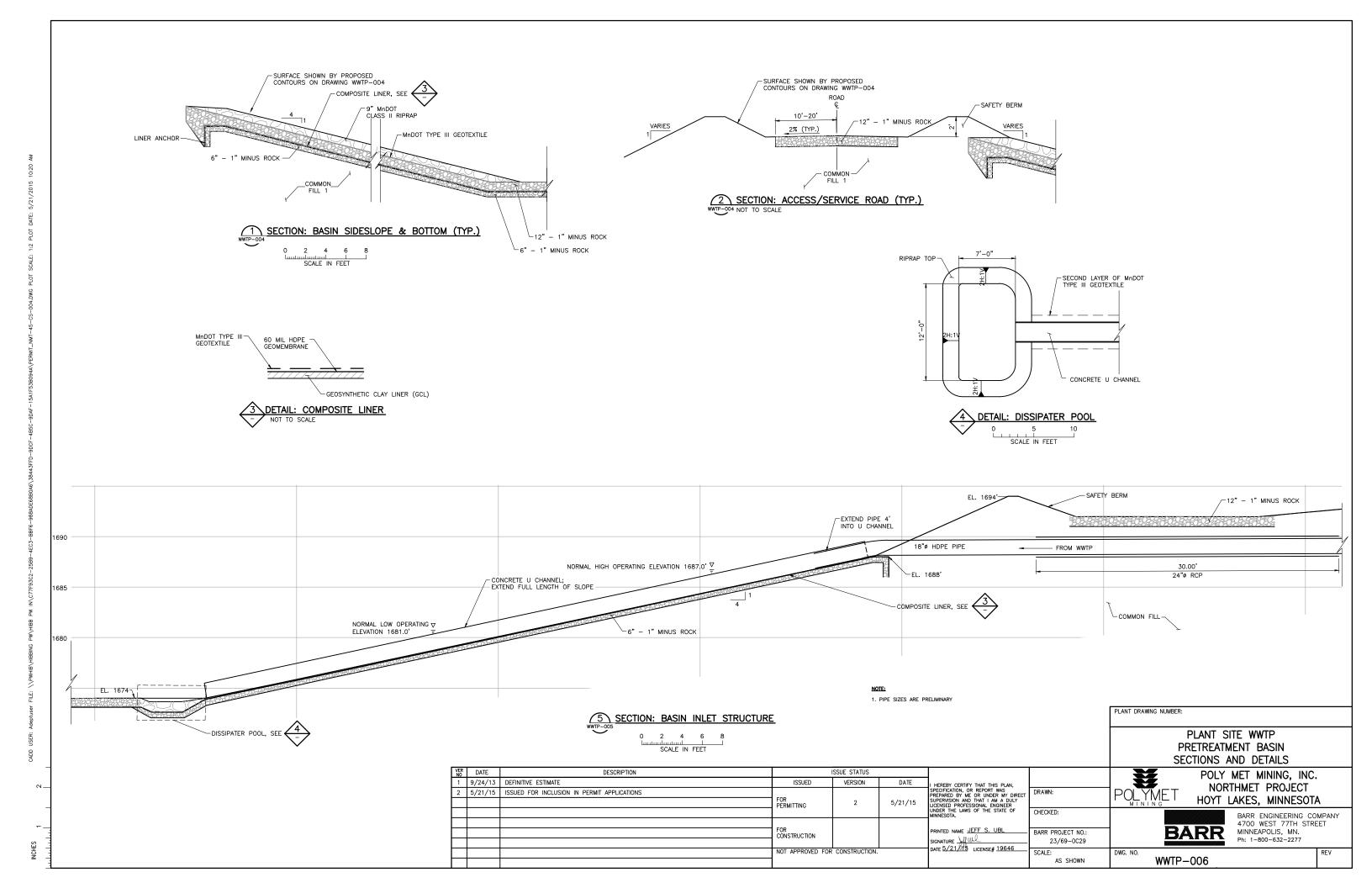
POLY MET MINING, INC. NORTHMET PROJECT HOYT LAKES, MINNESOTA



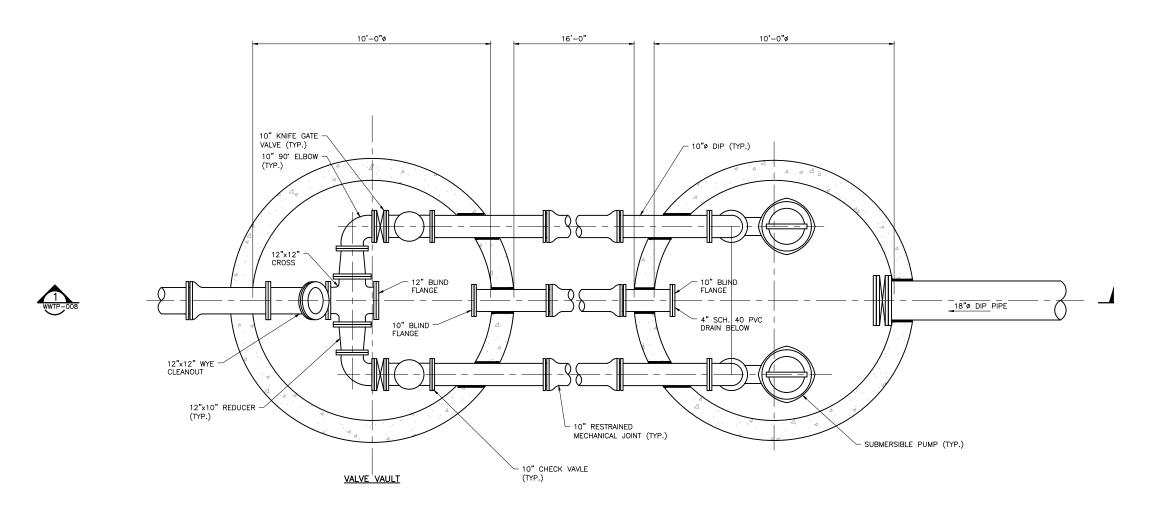
WWTP-002

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN.

Ph: 1-800-632-2277







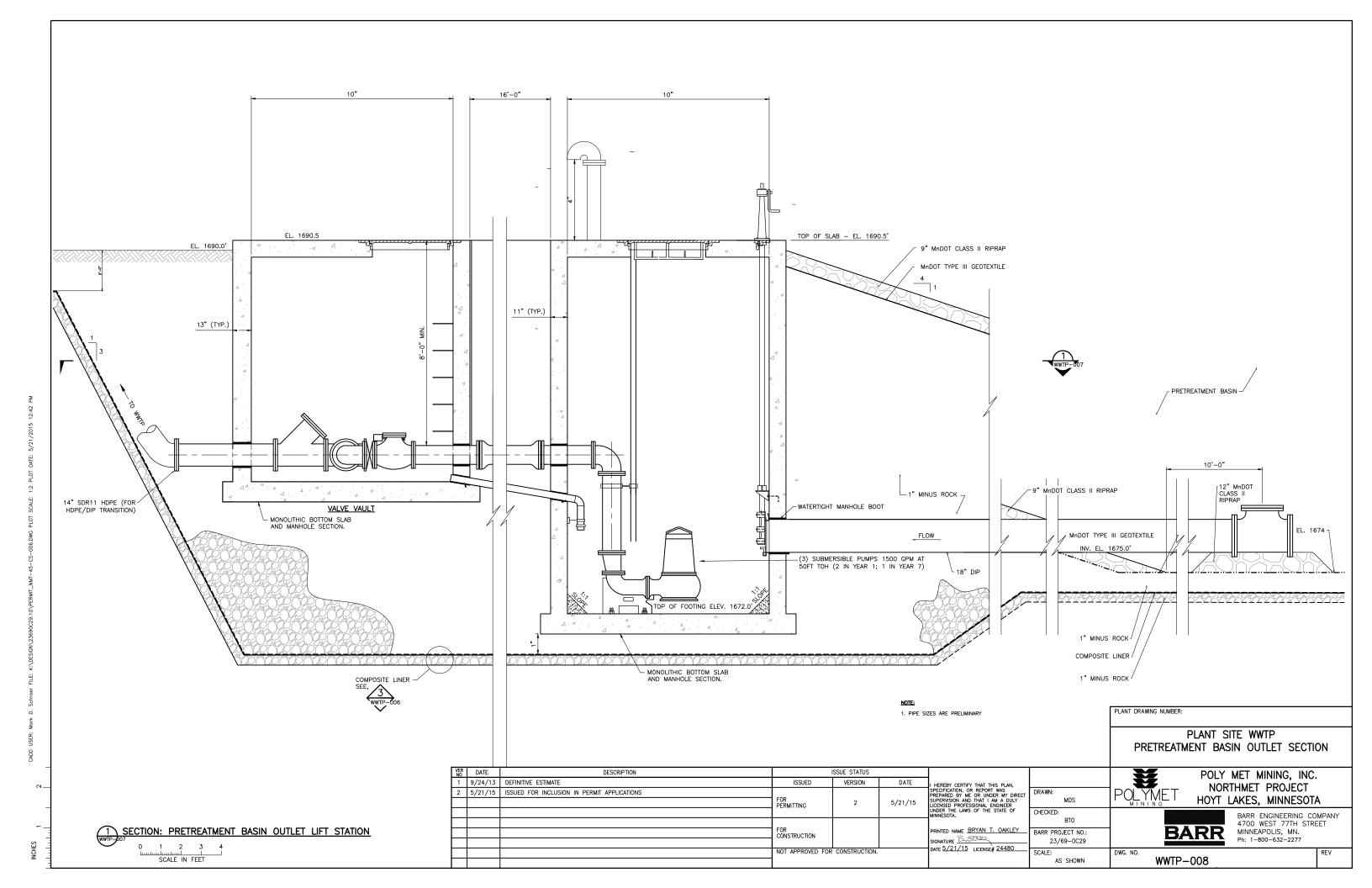
PLAN: PRETREATMENT BASIN OUTLET LIFT STATION

O 2 4
SCALE IN FEET

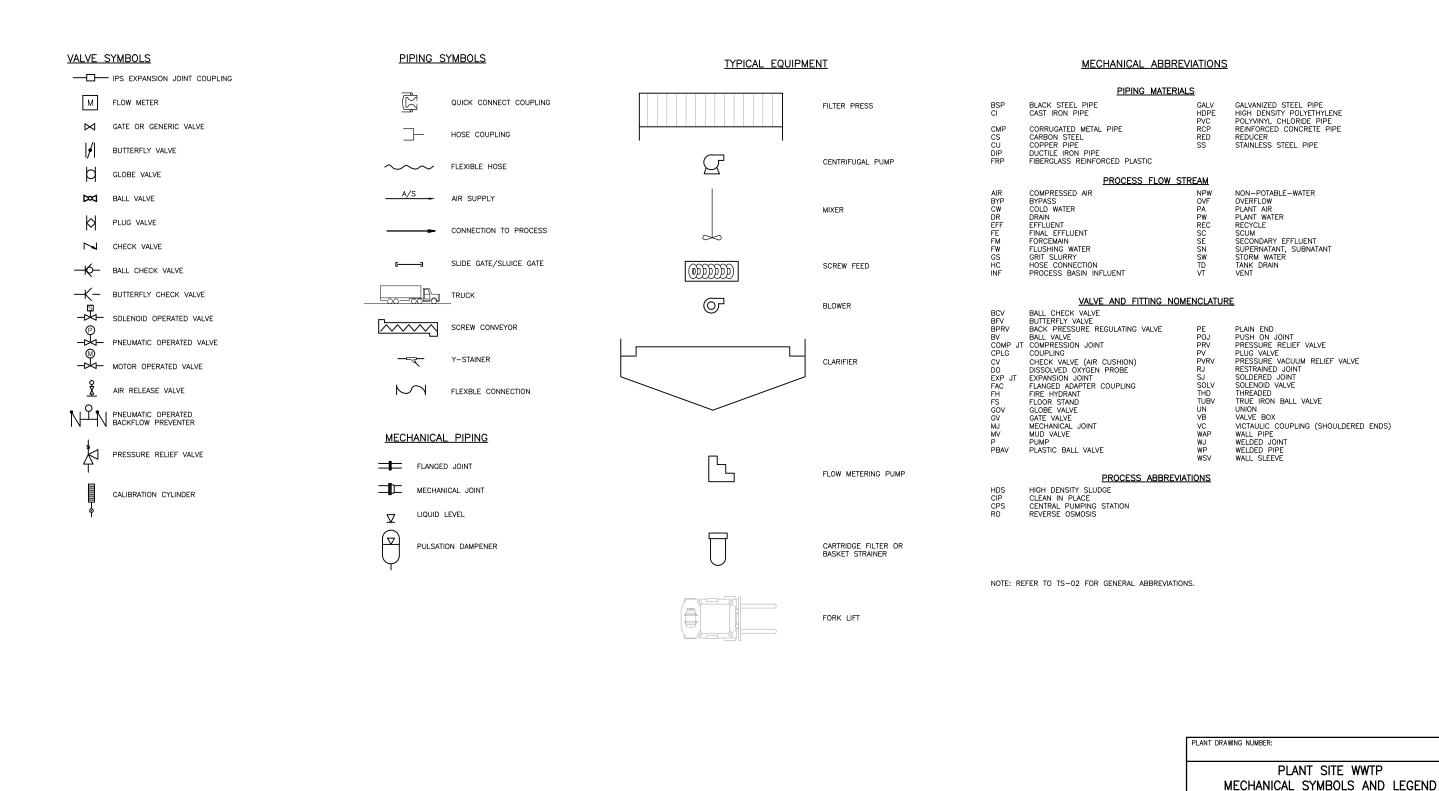
PIPE SIZES ARE PRELIMINARY

PLANT DRAWING NUMBER:

									NT SITE WWTP NT BASIN OUTLET PLAN
VER NO	DATE	DESCRIPTION		ISSUE STATUS				**	POLY MET MINING, INC.
1	5/21/15	ISSUED FOR INCLUSION IN PERMIT APPLICATIONS	ISSUED	VERSION	DATE	I HEREBY CERTIFY THAT THIS PLAN.		****	NORTHMET PROJECT
			FOR PERMITTING	1	5/21/15	SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER	DRAWN: MDS	POLYMET H	OYT LAKES, MINNESOTA
					l l	UNDER THE LAWS OF THE STATE OF MINNESOTA. PRINTED NAME BRYAN T. OAKLEY SIGNATURE	CHECKED: BTO		BARR ENGINEERING COMPANY 4700 WEST 77TH STREET
			FOR CONSTRUCTION				BARR PROJECT NO.: 23/69-0C29	BAF	MINNEAPOLIS, MN. Ph: 1-800-632-2277
			NOT APPROVED FOR	CONSTRUCTION.		DATE 5/21/15 LICENSE# 24480	SCALE: AS SHOWN	DWG. NO. WWTP-00	7







ISSUE STATUS

ISSUED

FOR PERMITTING

FOR CONSTRUCTION

NOT APPROVED FOR CONSTRUCTION.

VERSION

DATE

5/21/15

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF LIMINALECRIS.

PRINTED NAME BRYAN T. OAKLEY

DATE 5/21/15 LICENSE# 24480

DRAWN:

CHECKED:

MDS

BARR PROJECT NO .:

23/69-0029

AS SHOWN

VER DATE

1 5/21/15

DESCRIPTION

ISSUED FOR INCLUSION IN PERMIT APPLICATIONS

BARR

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET MINNEAPOLIS, MN. Ph: 1-800-632-2277

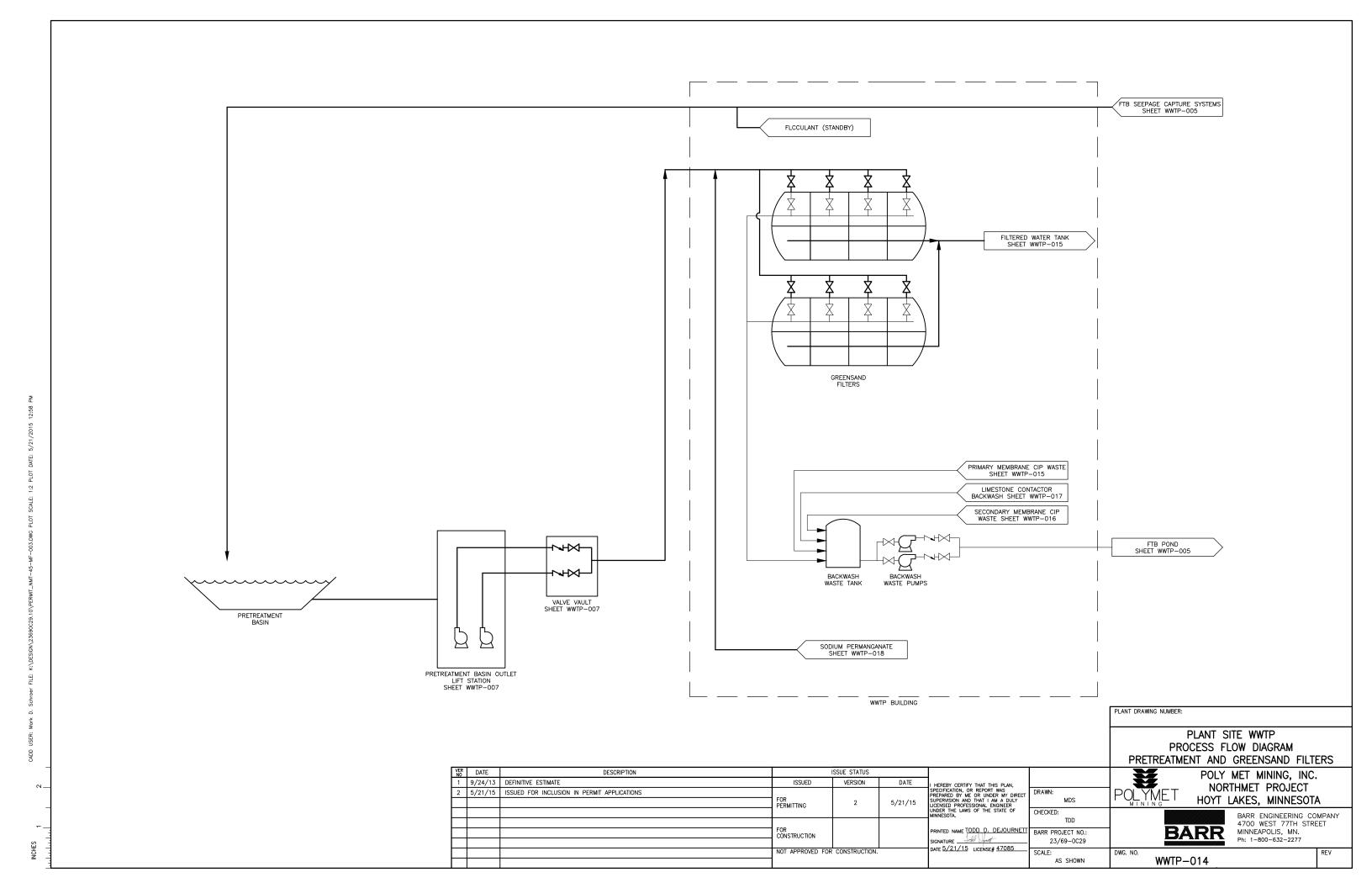
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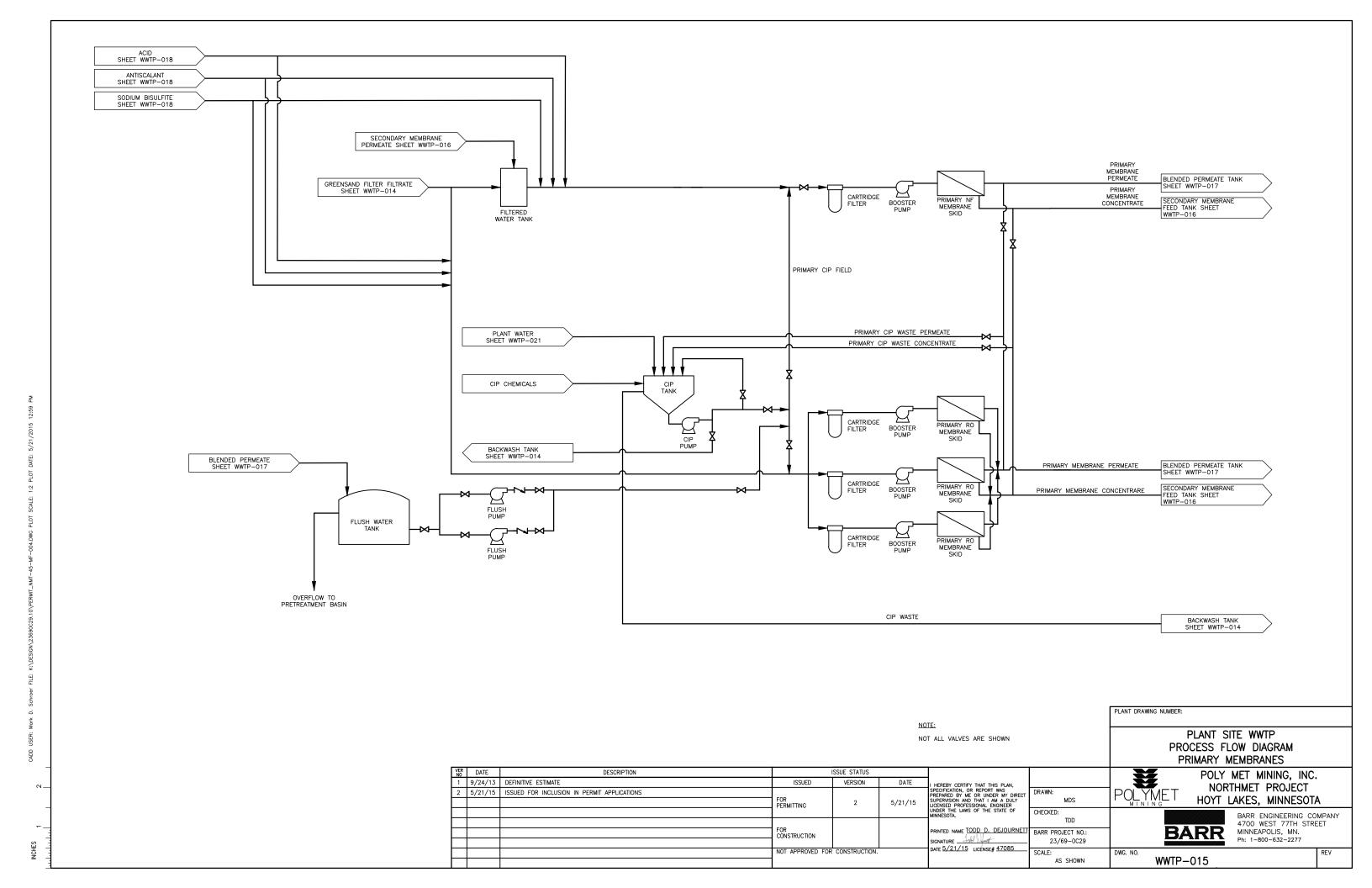
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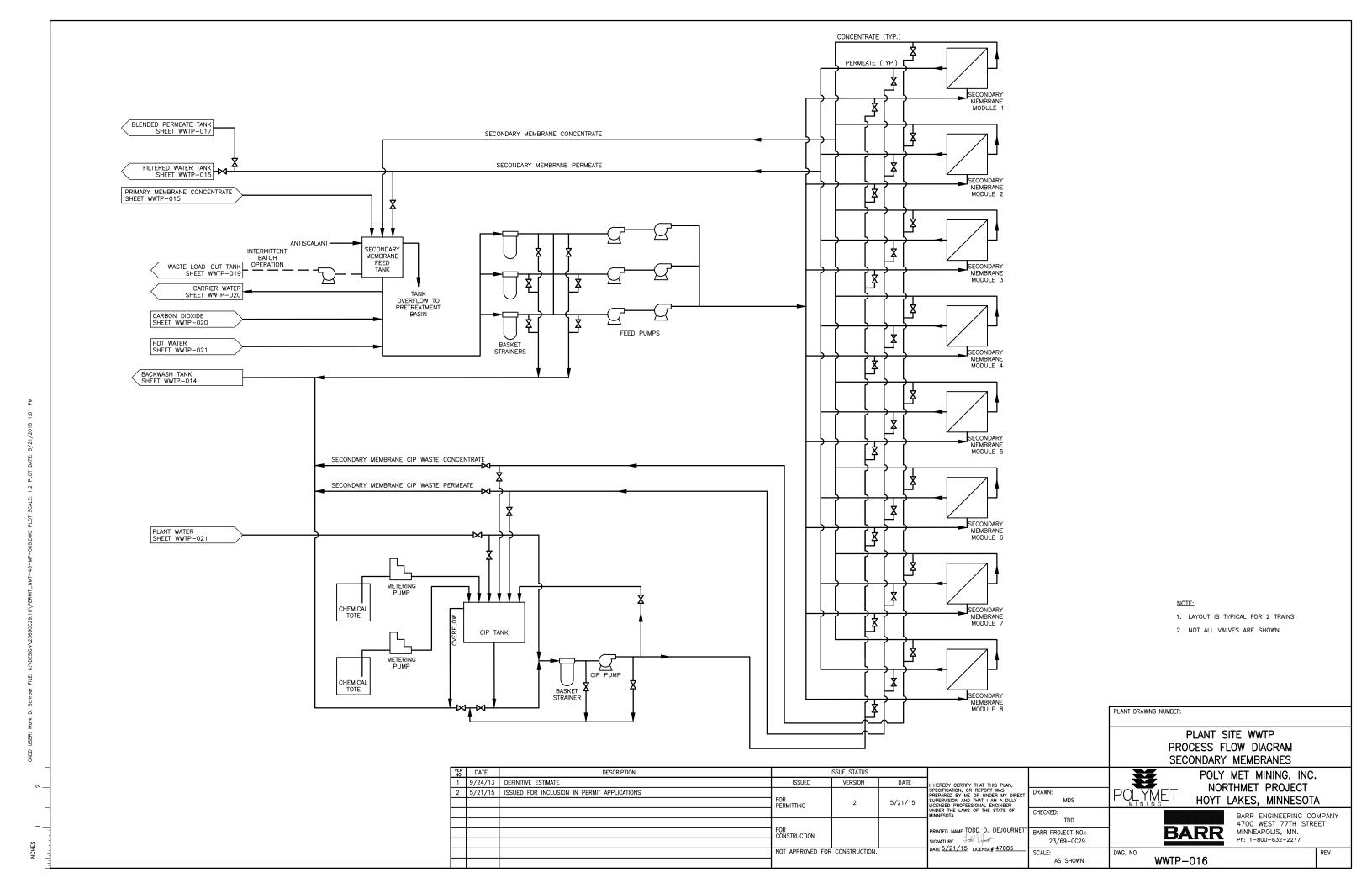
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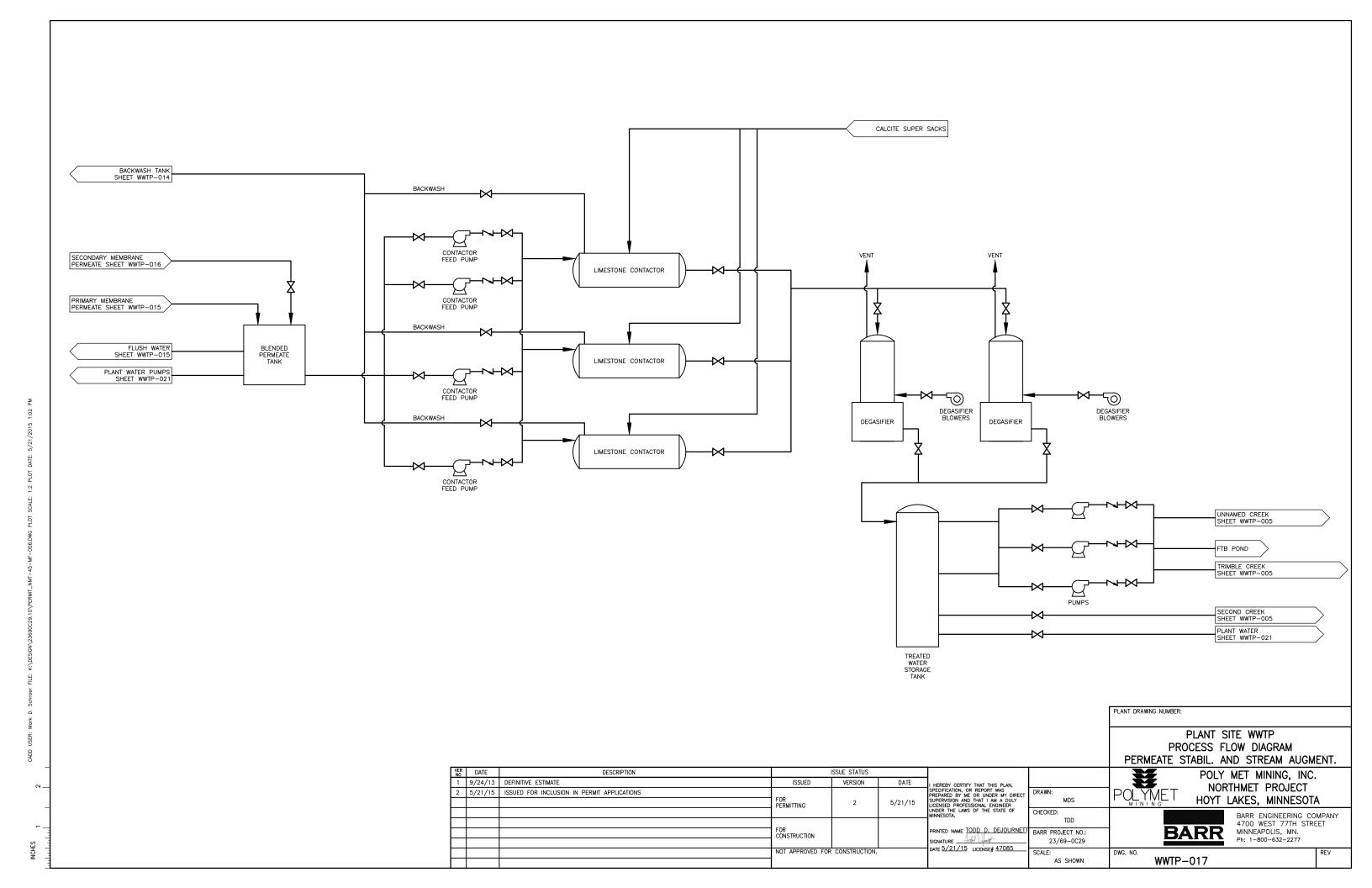
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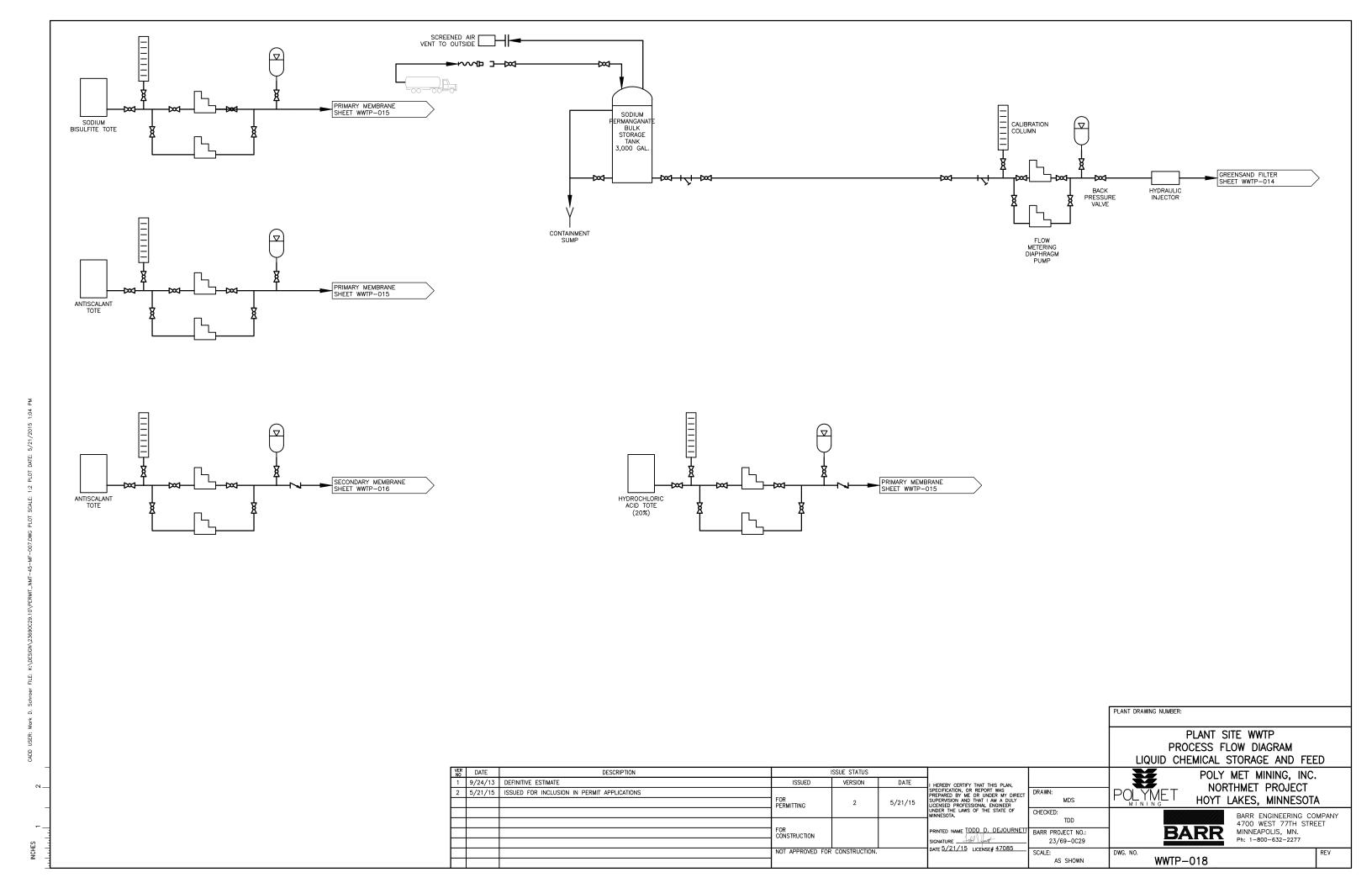
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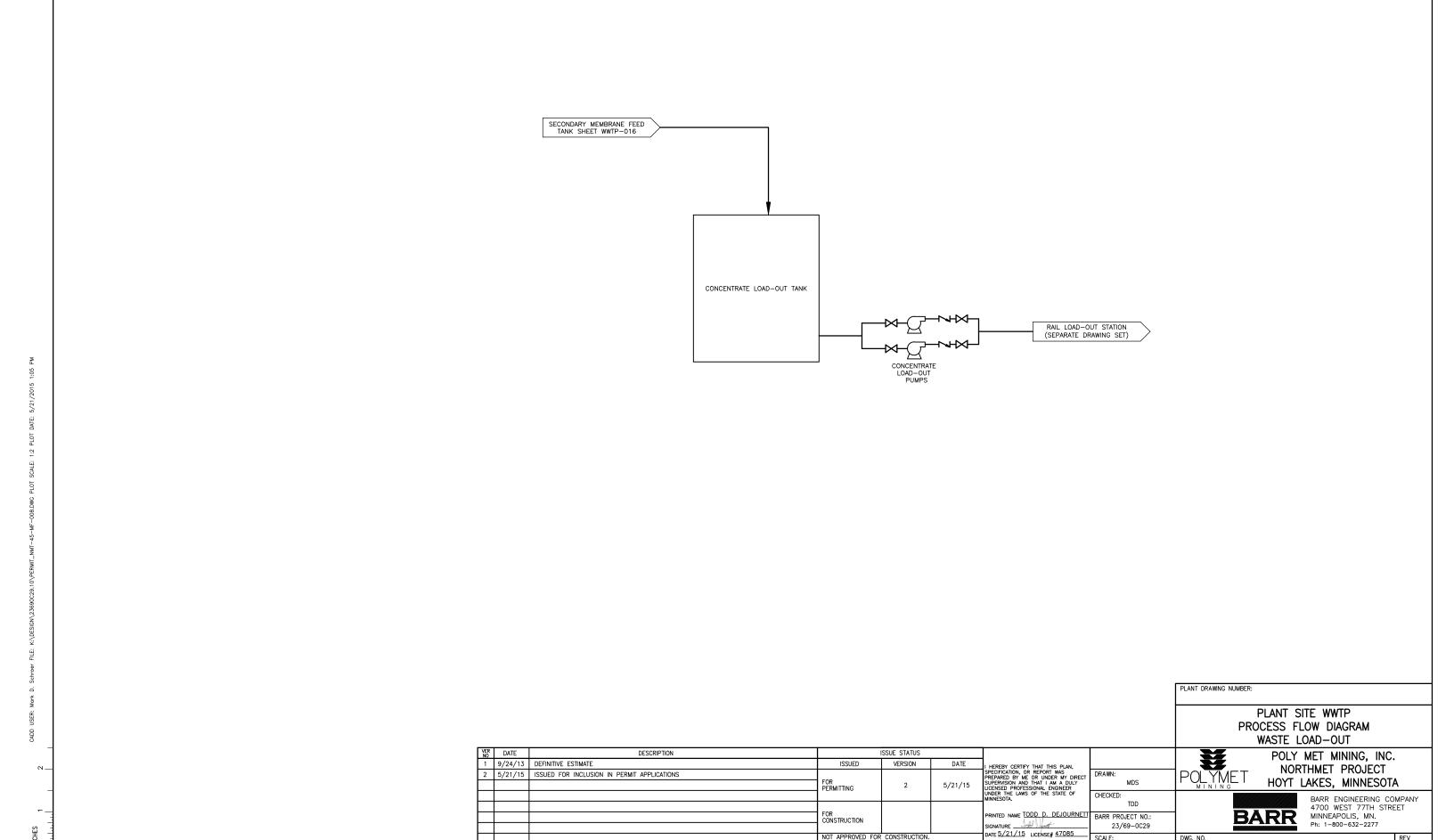








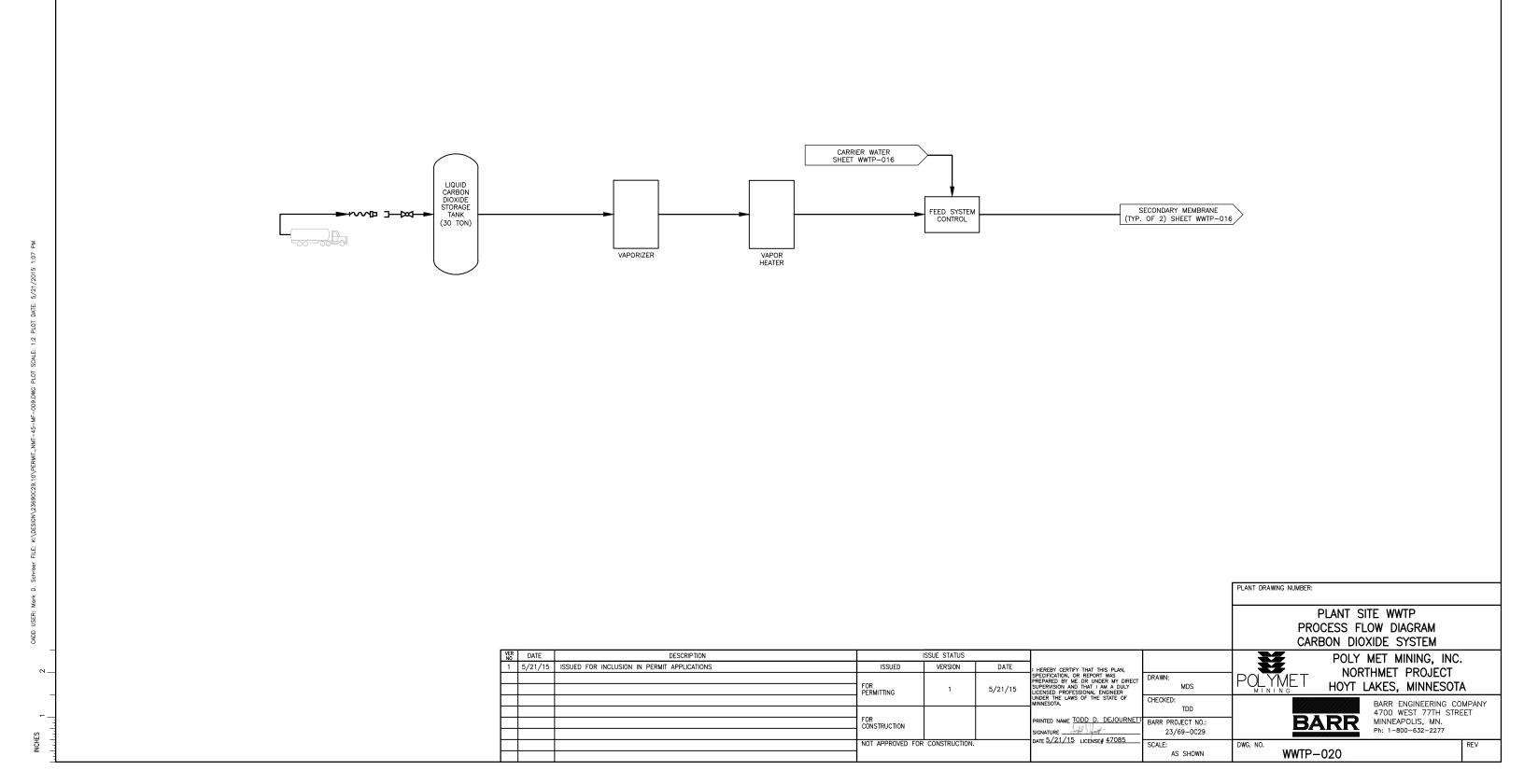


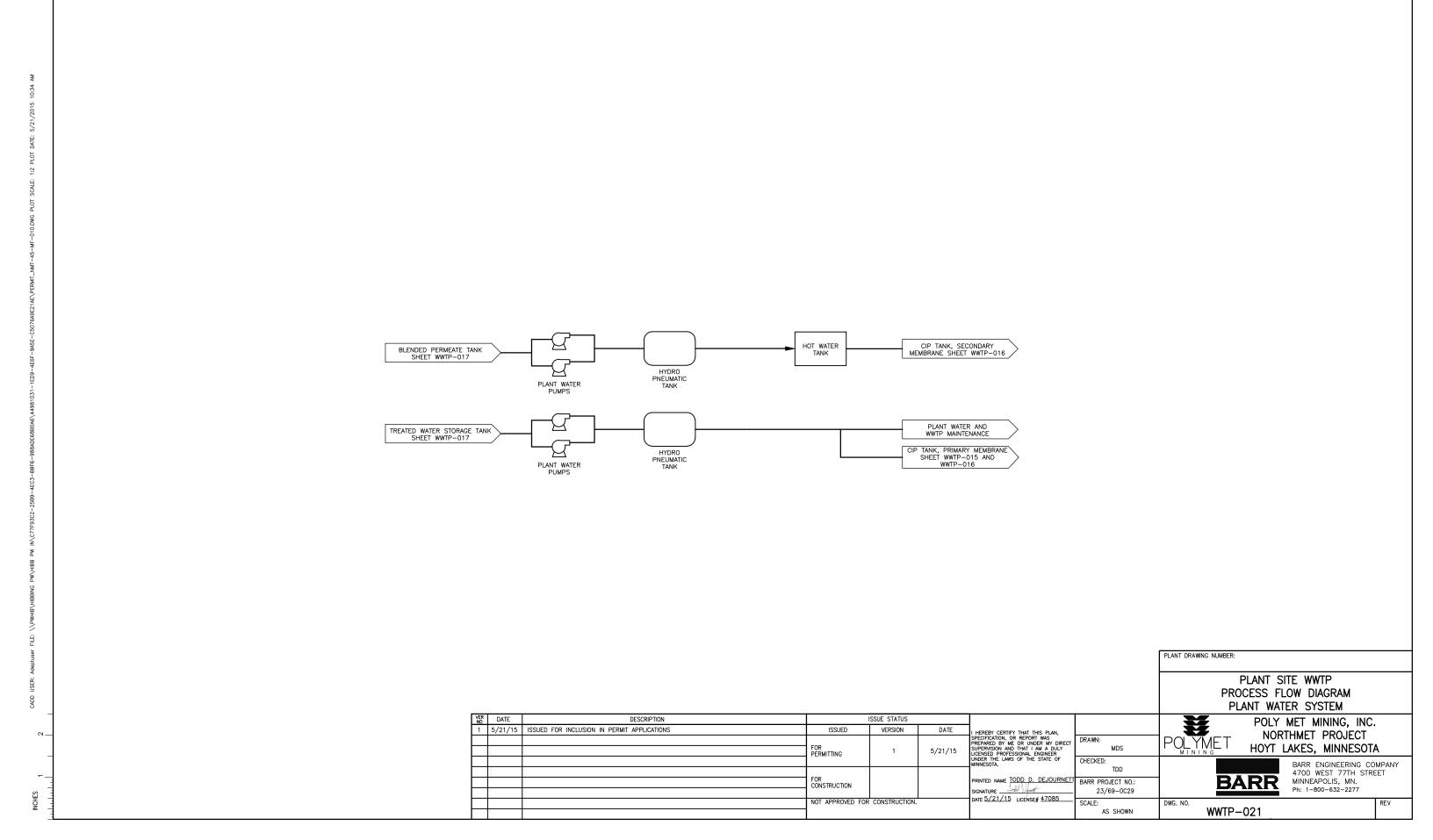


NOT APPROVED FOR CONSTRUCTION.

AS SHOWN

WWTP-019





SCALE

PLANT SITE WWTP
OVERALL GENERAL ARRANGEMENT

POLY MET MINING, INC.

BARR

WWTP-022

NORTHMET PROJECT

HOYT LAKES, MINNESOTA

MINNEAPOLIS, MN.

Ph: 1-800-632-2277

BARR ENGINEERING COMPANY 4700 WEST 77TH STREET

PLANT DRAWING NUMBER:

VER DATE DESCRIPTION ISSUE STATUS 1 9/24/13 DEFINITIVE ESTIMATE I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA. ISSUED VERSION DATE POLYMET ISSUED FOR INCLUSION IN PERMIT APPLICATIONS DRAWN: FOR PERMITTING MDS 5/21/15 CHECKED: PRINTED NAME BRYAN T. OAKLEY FOR CONSTRUCTION BARR PROJECT NO .: 23/69-0029 DATE 5/21/15 LICENSE #24480 NOT APPROVED FOR CONSTRUCTION AS SHOWN

D USER: Mark D. Schroer FILE: K:\DESIGN\23690C29.10\PERMIT_NMT—

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